The Department of Defense

DoD DEPARTMENTS/AGENCIES:

Department of the Army

Department of the Navy

Department of the Air Force

Defense Advanced Research Projects Agency

Defense Nuclear Agency

Strategic Defense Initiative Organization

DEFENSE SMALL BUSINESS INNOVATION RESEARCH PROGRAM (SBIR)

NATIONAL SBIR CONFERENCES

FEDERAL R&D OPPORTUNITIES
FOR
TECHNOLOGY INTENSIVE FIRMS

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EAST	WASHINGTON	OCTOBER 27-29, 1992
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FY 1991 SBIR SOLICITATION

PHASE I AWARD ABSTRACTS

DARPA, DNA AND SDIO PROJECTS

VOLUME IV

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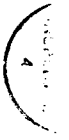

PREFACE

This report presents the technical abstracts of the Phase I proposals that resulted in contract awards from the Fiscal Year 1991 Solicitations of the Department of Defense (DoD) Small Business Innovation Research (SBIR) Program. The Army, Navy, Air Force, Defense Advanced Research Projects Agency (DARPA), Defense Nuclear Agency (DNA), and Strategic Defense Initiative Organization (SDIO) are the DoD components of the SBIR Program. Two solicitations inviting small business firms to submit proposals under this program were published in FY91. All six DoD components participated in Program Solicitation 91.1 (Closing Date: 11 January 1991), and Army, Navy, and DARPA participated in Program Solicitation 91.2 (Closing Date: 1 July 1991). The selection of proposals for funding was made from proposals received by the Military Services and Agencies.

FY 1991 SBIR PROGRAM

	Number of Topics		Proposals Received		Phase I Awards	
	91.1	91.2	91.1	91.2	91.1	91.2
Army	30	225	806	2033	60	219
Navy	290	77	2683	843	221	85
Air Force	202	–	2340	–	232	–
DARPA	83	160	838	1227	123	158
DNA	20	–	208	–	21	–
SDIO	15	–	632	–	128	–
Total	640	462	7507	4103	785	462
Grand Total	1102		11610		1247	

Of the 1247 Phase I awards, 159 awards went to minority-owned businesses and 105 awards were to woman-owned businesses. Overall, 10.7 percent of the FY91 SBIR proposals were selected for funding.

In order to make information available on the technical content of the Phase I projects supported by the DoD SBIR Program, four volumes containing the abstracts and contracts for the awarded projects are published. The small business information with accompanying abstract are arranged in alphabetical order by firm name. Cross reference indices appear at the back of the volume for quick reference.

- Volume I contains Army Projects
- Volume II contains Navy Projects
- Volume III contains Air Force Projects
- Volume IV contains DARPA, DNA and SDIO Projects

Venture capital and large industrial firms that may have an interest in the research described in the abstracts in this publication are encouraged to contact the firm whose name and address is shown.

INTRODUCTION

In 1982, Congress enacted and the President signed the "Small Business Innovation Development Act of 1982" (Public Law 97-219), which created the Small Business Innovation Research (SBIR) Program to give small, high-technology firms a greater share of the federally-funded research and development contract awards.

Under the SBIR Program, each federal agency with an extramural budget for research or research and development in excess of $100 million per fiscal year must establish an SBIR Program. The program is funded by setting aside 1.25 percent of the participating agency's extramural R&R&D contracting dollars. The agencies participating in the Department of Defense SBIR Program are the Army, Navy, Air Force, Defense Advanced Research Projects Agency (DARPA), Defense Nuclear Agency (DNA), and Strategic Defense Initiative Organization (SDIO).

The objectives of the DoD SBIR Program include stimulating technological innovation in the private sector, strengthening the role of small business in meeting DoD research and development needs, encouraging participation by minority and disadvantaged persons in technological innovation, and increasing the commercial application of DoD-supported research or research and development.

The SBIR Program consists of three distinct phases. Under Phase I, DoD components make awards to small businesses, typically of up to one man-year of effort over a period of six months, subject to negotiation. Phase I is to determine, insofar as possible, the scientific or technical merit and feasibility of ideas or concepts submitted in response to SBIR topics. Proposals selected for contract award are those which contain an approach or idea that holds promise to provide an answer to the specific problem addressed in the topic. Successful completion of Phase I is a pre-requisite for further DoD support in Phase II.

Phase II awards will be made only to firms on the basis of results from the Phase I effort, and the scientific and technical merit of the Phase II proposal. Proposals which identify a follow-on Phase III funding commitment from non-Federal sources will be given special consideration. Phase II awards will typically cover two to five man-years of effort over a period of 24 months, also subject to negotiation. The number of Phase II awards will depend upon the success rate of the Phase I effort and availability of funds. Phase II is the principal research or research and development effort, and requires a comprehensive proposal outlining the intended effort in detail.

In Phase III, an innovation is brought to the marketplace by private sector investment and support. No SBIR funds may be used in Phase III. Also, under Phase III, DoD may award follow-on contracts with non-SBIR funds for products and processes meeting DoD mission needs.

Proposals received in response to a DoD solicitation are evaluated on a competitive basis in the organization which generated the topic, by scientists and engineers knowledgeable in that area. Selections for Phase I are made in accordance with the following criteria:

- The scientific/technical quality of the research proposal and its relevance to the topic description, with special emphasis on its innovation and originality.
- Qualifications of the principal investigator, other key staff, and consultants, if any, and the adequacy of available or obtainable instrumentation and facilities.
- Anticipated benefits of the research to the total DoD research and development effort.
- Adequacy of the Phase I proposed effort to show progress toward demonstrating the feasibility of the concept.

Public Law 99-443, the "Small Business Innovation Act of 1986" was signed by the President on October 6, 1986. This law re-authorized Public Law 97-219 (signed July 22, 1982) to extend the "Sunset Clause" to 1993; to continue 1.25 percent taxation of the extramural research and development budget; and excludes from taxation those amounts of the DoD research and development budget obligated solely for operational systems development.

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Topic#: 91-095 ID#: 9120913
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Contract #: DAAH0192CR202
PI: ZHEN-HONG ZHOU
Title: NON-CONTACT NON-INVASIVE SMART IR SENSOR FOR IN-SITU DIAGNOSTICS IN CVD REACTORS
Abstract: A NOVEL NON-CONTACT NON-INVASIVE INFRARED (IR) SENSOR IS PROPOSED FOR IN-SITU DIAGNOSTICS IN CVD REACTORS. DURING CVD PROCESSES, THE SUBSTRATES WILL BE HEATED. THE IR SENSOR TAKES THE ADVANTAGE OF THE HEATED SUBSTRATE AS THE SOURCES OF IR RADIATION. BY SENSING AND ANALYZING THE IR RADIATION FROM A SUBSTRATE, THE SUBSTRATE SURFACE CAN BE PROBED. MOREOVER, LOW TEMPERATURE SILICON EPITAXY HAS BEEN CHOSEN AS THE TEST VEHICLE, AND THE NEEDS OF A SENSOR FOR MONITORING AND CONTROL OF CRITICAL PARAMETERS IN AN EPITAXIAL CVD REACTOR WILL BE IDENTIFIED. OUR GOAL IS TO ASSESS THE FEASIBILITY OF THIS IR SENSOR FOR PROBING SEMICONDUCTOR SURFACES. AND EXAMINE THE POSSIBILITIES OF USING THIS SENSOR TO FULFILL THE MONITORING NEED IN EPITAXIAL CVD PROCESSES. AFTER SUCCESSFUL DEMONSTRATION OF THE PHASE I RESEARCH, THE NOVEL SENSOR WILL BE INCORPORATED INTO CANDIDATE MANUFACTURING TOOLS FOR REAL-TIME PROCESS MONITORING AND CONTROL. THE SMART SENSOR OFFERS MORE FLEXIBILITIES IN CONTROLLING CRITICAL MANUFACTURING PROCESSES TO MEET THE STRINGENT REQUIREMENTS OF THE FUTURE GENERATION OF DEVICES. IT CAN BE INTEGRATED IN THE FUTURE MANUFACTURING TOOL (CLUSTER TOOL) FOR REAL-TIME PROCESS MONITORING AND CONTROL.

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Topic#: 91-143 ID#: 9120228
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Contract #: DAAH0182CR148
PI: LAWRENCE BRENNAN
Title: *ANGLE TRACKING AND SCATTERED JAMMING CANCELLATION IN ADAPTIVE DIGITAL ARRAY RADARS*
Abstract: ADAPTIVE DIGITAL ARRAY PROCESSING IN AIRBORNE RADARS CAN PROVIDE A MAJOR IMPROVEMENT IN TARGET DETECTABILITY BY ADAPTIVELY SUPPRESSING CLUTTER AND JAMMING. THE EFFECTIVENESS OF THIS SPACE-TIME ADAPTIVE PROCESSING HAS BEEN DEMONSTRATED BY DETAILED SIMULATION AT ASI. RECENTLY, ARRAY RADAR FLIGHT TEST DATA WAS USED TO VERIFY THE PERFORMANCE OF ADAPTIVE RADAR. THE PROPOSED STUDY WILL EXTEND THE SIMULATION OF SPACE-TIME ADAPTIVE RADAR TO ANGLE TRACKING AND TO THE CANCELLATION OF SCATTERED JAMMING. ONE OBJECTIVE OF THE EFFORT IS THE DEVELOPMENT OF ALGORITHMS FOR ANGLE MEASUREMENT IN ADAPTIVE ARRAY RADARS WHERE THE ANTENNA PATTERNS ARE ADAPTED IN RESPONSE TO CLUTTER AND JAMMING. THE PATTERN DISTORTIONS ADD ERRORS TO CONVENTIONAL ANGLE TRACKERS, SUCH AS MONOPULSE. A MAXIMUM LIKELIHOOD ANGLE ESTIMATOR FOR THESE SYSTEMS WILL BE SIMULATED USING MODIFIED VERSIONS OF THE EXISTING ASI PROGRAMS. THE SECOND PROGRAM OBJECTIVE IS THE DEVELOPMENT AND SIMULATION OF ADAPTIVE ARRAY ALGORITHMS FOR SUPPRESSING SCATTERED JAMMING IN ADDITION TO CLUTTER AND DIRECT JAMMING. SCATTERED JAMMING IS A POSSIBLE LIMITATION IN SYSTEMS WHERE DIRECT LINE-OF-SIGHT JAMMING IS NULLED ADAPTIVELY TO A LOW LEVEL. JAMMING SCATTERED INTO THE MAIN BEAM OF A RADAR CANNOT BE NULLED IN ANGLE. A METHOD OF CANCELING THIS SCATTERED JAMMING IS DESCRIBED IN THE PROPOSAL. THE ANGLE TRACKING TECHNIQUES DEVELOPED DURING THE PROGRAM WILL PROVIDE AN IMPORTANT CAPABILITY FOR MISSILE SEEKERS AND AIRBORNE RADARS OPERATING IN CLUTTER AND JAMMING. SCATTERED JAMMING SUPPRESSION IS ALSO IMPORTANT FOR FUTURE ADAPTIVE RADARS.

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Title: ADAPTIVE RADAR TECHNIQUES FOR IMPROVING CLUTTER SUPPRESSION AND DETECTION OF LOW CROSS SECTION TARGETS

Abstract: AIRBORNE RADARS FOR THE DETECTION AND TARGETING OF LOW CROSS SECTION GROUND VEHICLES MUST TRANSMIT MORE POWER, USE LARGER ANTENNAS, AND/OR OPERATE AT SHORTER RANGES TO ACHIEVE THE REQUIRED SIGNAL-TO-NOISE RATIOS. IN ADDITION, A MAJOR IMPROVEMENT IN SUBCLUTTER VISIBILITY IS REQUIRED. THIS PROPOSAL DESCRIBES A METHOD OF SIGNIFICANTLY IMPROVING THE SUBCLUTTER VISIBILITY OF SPACE-TIME ADAPTIVE RADARS AT THE COST OF INCREASED DIGITAL SIGNAL PROCESSING. UNDER THE PROPOSED EFFORT, THE ASI COMPUTER SIMULATION OF SPACE-TIME ADAPTIVE RADAR WILL BE EXTENDED TO INCLUDE AN ADDITIONAL DIMENSION OF ADAPTIVITY. THE PROGRAM NOW SIMULATES SEVERAL DIFFERENT RADAR/SIGNAL PROCESSOR ALGORITHMS FOR ADAPTIVELY CONTROLLING THE ANGULAR AND DOPPLER FREQUENCY RESPONSES OF THE SYSTEM. ADAPTIVE WEIGHTING OF CONSECUTIVE SAMPLES (TRANSVERSAL FILTERING) WILL BE ADDED TO THE SIMULATION, IN ADDITION TO THE PRESENT WEIGHTING OF ANTENNA OUTPUTS AND CONSECUTIVE PULSES. SUBBANDING WILL BE ADDED TO THE MODEL AND COMPARED WITH TRANSVERSAL FILTERING. THIS ADDITIONAL ADAPTIVITY WILL COMPENSATE FOR DISPERSIVE DIFFERENCES IN THE ARRAY ELEMENT PATTERNS DUE TO NEAR FIELD SCATTERING FROM THE AIRCRAFT STRUCTURE. BOTH THE ELEMENT PATTERN VARIATIONS WITH FREQUENCY AND INTERCHANNEL RECEIVER MISMATCHES WILL BE MODELED. THE PROGRAM WILL BE USED TO ESTIMATE THE IMPROVEMENT IN SUBCLUTTER VISIBILITY WITH THE ADDITIONAL ADAPTIVITY AND IN SYSTEM COMPARISONS. SIMULATION RESULTS WILL SHOW HOW MUCH ADDITIONAL CLUTTER REJECTION CAN BE OBTAINED WITH TRANSVERSAL FILTERING AND SUBBANDING IN SPACE-TIME ADAPTIVE RADARS. THE IMPROVEMENT IN RADAR CLUTTER SUPPRESSION IS NECESSARY FOR THE DETECTION AND TARGETING OF LOW CROSS SECTION GROUND TARGETS.

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Topic#: 91-078 ID#: 9110434
Office:
Contract #: DAAH0191CR261
PI: LOUIS BAKER
Title: HARDWARE IMPLEMENTATION OF OPTICAL CHARACTER RECOGNITION USING ARTIFICIAL NEURAL NETWORKS
Abstract: WE PROPOSE TO DEMONSTRATE THE FEASIBILITY OF OPTICAL CHARACTER RECOGNITION (OCR) ON A VLSI NEUROCOMPUTER. THE OCR SYSTEM WILL USE STATE OF THE ART ARTIFICIAL NEURAL NETWORK CLASSIFIERS ON ADAPTIVE SOLUTIONS' CNAPS NEUROCOMPUTER CHIPS. THE CNAPS CHIPS OFFER UNPRECEDENTED PERFORMANCE OF ARTIFICIAL NEURAL NETWORKS. THE IMAGE PREPROCESSING OF THE OCR SYSTEM WILL ALSO EXECUTE ON THE CNAPS CHIPS. THE GOAL OF THE PHASE I RESEARCH IS TO IMPLEMENT THE OCR SOFTWARE ON ACNAPS DEVELOPMENT SYSTEM, ANALYZE I/O AND SYSTEM PERFORMANCE, AND CREATE A BOARD LEVEL ARCHITECTURE FOR AN OCR SYSTEM. THE GOAL OF THE PHASE II RESEARCH IS TO DESIGN AND BUILD THE OCR SYSTEM HARDWARE. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - OPTICAL CHARACTER RECOGNITION TECHNOLOGY IS USEFUL TO THE DEPARTMENT OF DEFENSE FOR THE COMPUTER AIDED LOGISTICS PROGRAM, ELECTRONIC BACKUP OF EXISTING DOCUMENTS, AND FORMS PROCESSING.

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Topic#: 91-095 ID#: 9120719
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Contract #: DAAH0192CR017
PI: PHILIP MORRISON JR.
Title: PROCESS MONITORING AND CONTROL DURING MOCVD OF FERROELECTRIC THIN FILMS
Abstract: FERROELECTRICS (FE) HAVE A LARGE COMMERCIAL POTENTIAL AS PIEZOELECTRIC ELEMENTS, DIELECTRICS FOR CAPACITORS, AND IN OPTICAL GUIDED-WAVE DEVICES. MATERIALS PROCESSING HAS LIMITED APPLICATIONS IN MICROELECTRONICS AND PHOTONICS, HOWEVER, AND FEW METHODS ARE CAPABLE OF DEPOSITING HIGH QUALITY THIN FILMS COMPATIBLE WITH STANDARD SI INTEGRATED CIRCUIT PROCESS TECHNOLOGY. METALORGANIC CHEMICAL VAPOR DEPOSITION (MOCVD) IS A PROMISING TECHNOLOGY TO DEPOSIT SUCH THIN FILMS BECAUSE OF ITS LOW COST, ITS ABILITY TO ACHIEVE EPITAXIAL FILM GROWTH AT HIGH DEPOSITION RATES, AND THE EASE OF PROCESS SCALING TO

COMMERCIAL VOLUMES. ALTHOUGH MANY TECHNOLOGICAL HURDLES HAVE BEEN OVERCOME, THE LACK OF ADEQUATE PROCESS MONITORING AND CONTROL IS BECOMING THE DOMINANT FACTOR SLOWING FUTURE DEVELOPMENT OF MOCVD TECHNIQUES FOR FE DEPOSITION. AT PRESENT, PROCESS SENSING IS NOT PERFORMED, AND PROCESS CONTROL CONSISTS OF RIGID CONTROL OF INPUT SETPOINTS. THIS PROPOSAL WILL APPLY IN-SITU FOURIER TRANSFORM INFRARED (FT-IR) SPECTROSCOPY FOR PROCESS MONITORING AND CONTROL OF MOCVD OF FE THIN FILMS. THE PROJECT COMBINES THE STATE-OF-THE-ART FT-IR TECHNIQUES OF ADVANCED FUEL RESEARCH, INC. (AFR) WITH THE ADVANCED MOCVD TECHNOLOGIES OF ADVANCED TECHNOLOGY MATERIALS, INC. (ATM). THIS RESEARCH WILL DEMONSTRATE THE CAPABILITY OF A SINGLE FT-IR INSTRUMENT TO MONITOR SIMULTANEOUSLY AND IN-SITU SUCH PARAMETERS AS GAS COMPOSITION, FILM COMPOSITION, AND SUBSTRATE TEMPERATURE. THIS DEMONSTRATION WILL TAKE PLACE ON ONE OF ATM'S ADVANCED MOCVD REACTOR CURRENTLY DEPOSITING BATIO3 THIN FILMS. THIS PROJECT WILL ALSO CORRELATE THE IR PROPERTIES OF THE THIN FILMS WITH THEIR ELECTRICAL, OPTICAL, AND DEVICE PROPERTIES TO IDENTIFY POTENTIAL CONTROL STRATEGIES. PHASE II OF THIS PROPOSAL WILL EXTEND THESE NEW RESULTS TO DEVELOP A RUGGED SPECTROMETER FOR USE ON LARGE SCALE DEPOSITION REACTORS. THE ANTICIPATED RESULT OF THIS PROPOSAL IS A RUGGED AND INEXPENSIVE SPECTROMETER THAT IS CAPABLE OF MONITORING AND CONTROLLING AN MOCVD REACTOR. SUCH A CONTROL TOOL WOULD IMPROVE THE QUALITY AND PERFORMANCE OF FERROELECTRIC MEMORY AND OPTO-ELECTRICAL DEVICES.

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Topic#: 91-024
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Contract #: DAAH0191CR158
PI: EVERETT KING

ID#: 9110415

Title: NON-DESTRUCTIVE EVALUATION OF IMPURITIES AND DEFECTS IN ULTRA-THIN SEMICONDUCTOR FILMS

Abstract: THE SCANNING PHOTOVOLTAGE (SPV) TECHNIQUE IS A NON-DESTRUCTIVE, HIGH RESOLUTION OPTICAL METHOD FOR MAPPING ELECTRICALLY-ACTIVE DEFECTS IN SEMICONDUCTORS. THE POTENTIAL OF THE SPV TECHNIQUE HAS NOT BEEN REALIZED FOR MODERN, ULTRA-THIN FILM MATERIALS, HOWEVER, BECAUSE OF MULTIPLE REFLECTION INTERFERENCE EFFECTS WHICH MASK THE DEFECT-RELATED SIGNALS. MEASUREMENTS ARE FURTHER HAMPERED BY LOW SIGNAL-TO-NOISE RATIOS CAUSED BY THE HIGH IMPEDANCE NATURE OF THE THIN-FILMS. ARACOR PROPOSES TO DEVELOP AN SPV SYSTEM WHICH IS UNIQUELY SUITED TO INSPECT ULTRA-THIN FILM DEVICE MATERIALS IN REAL-TIME AT THE MANUFACTURER. THIS SPECIAL SPV SYSTEM WILL PROVIDE A PROBE LIGHT SOURCE WHOSE WAVELENGTH IS SELECTABLE. THEN, BY MATCHING THE WAVELENGTH OF THE PROBE TO THE ABSORPTION COEFFICIENT OF THE THIN FILM MATERIAL, THE INTERFERENCE EFFECTS CAN BE ELIMINATED. IN ADDITION, THE SYSTEM WILL INCORPORATE A STEADY-STATE BIAS LIGHT TO DECREASE THE FILM RESISTANCE. IN PHASE I, THE PROPOSED CONCEPT WILL BE DEMONSTRATED ON THIN SILICON-ON-INSULATOR (SIMOX) MATERIAL. PROBE WAVELENGTH, SPOT SIZE, AND BIAS LIGHT INTENSITY WILL BE VARIED TO DEMONSTRATE HOW THE SIGNAL-TO-NOISE RATIO OF THE PV SIGNAL CAN BE OPTIMIZED. THE DEFECTS DETECTED IN THE SOI SAMPLES USING THE MODIFIED SPV APPROACH WILL BE CORRELATED TO THE DEFECTS IDENTIFIED USING CONVENTIONAL TECHNIQUES. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE RESULT OF THIS PROGRAM WILL BE A DEMONSTRATED, HIGH RESOLUTION, NON-DESTRUCTIVE TEST CAPABILITY TO DETECT AND CHARACTERIZE DEFECTS AND IMPURITIES IN VERY THIN SEMICONDUCTOR FILMS. THIS CAPABILITY WILL AID THE MATERIAL MANUFACTURER IN EVALUATING AND IMPROVING HIS FILMS AS WELL AS THE DEVICE MANUFACTURER IN QUALIFYING AND SORTING

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Topic#: 91-025
Office:
Contract #: DAAH0191CR155
PI: LOUIS KOPPEL

ID#: 9110370

Title: MICROELECTRONICS CLUSTER TOOL SENSOR DEVELOPMENT

Abstract: THE U.S. SEMICONDUCTOR DEVICE FABRICATION INDUSTRY, WITH THE SUPPORT OF THE DEPARTMENT OF DEFENSE, IS RAPIDLY DEVELOPING THE CLUSTER TOOL CONCEPT AS THE BASIS FOR ADVANCED DEVICE MANUFACTURING. THIS CONCEPT PROVIDES THE CLEAN VACUUM PROCESSING ENVIRONMENT NECESSARY FOR HIGH-YIELD PRODUCTION OF SUBMICRON-SCALE INTEGRATED CIRCUITS, AND PROMOTES ENHANCED PROCESS FLEXIBILITY AND IMPROVED FABRICATION-LINE RELIABILITY. FOR DYNAMIC PROCESSES SUCH AS CHEMICAL VAPOR DEPOSITION (CVD), REAL-TIME PROCESS-CONTROL MONITORING OF AS-BUILT THIN-FILM PROPERTIES IS VITAL. THE PROPOSED PHASE I EFFORT WILL EVALUATE THE ABILITY OF AN INNOVATIVE SOFT X-RAY GAUGING TECHNOLOGY TO PROVIDE IN-SITU THIN-FILM THICKNESS MONITORING, AND OF ADVANCED DIFFRACTION TOPOGRAPHY TECHNIQUES TO MONITOR THIN-FILM SHEET RESISTIVITIES ON A NON-INTRUSIVE BASIS. THIS EFFORT WILL SET THE STAGE FOR INCORPORATION OF THE THIN-FILM GAUGING AND TOPOGRAPHY MEASUREMENTS INTO AN INTEGRATED CLUSTER-TOOL SENSOR PACKAGE IN PHASE II OF THE PROJECT. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - A SUCCESSFUL PROJECT WILL PRODUCE IN-SITU PROCESS-CONTROL SENSORS THAT CONTRIBUTE TO THE DEVELOPMENT AND APPLICATION OF CLUSTER TOOL FABRICATION SYSTEMS WITHIN THE U.S. SEMICONDUCTOR DEVICE FABRICATION INDUSTRY.

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Topic#: 91-033 ID#: 9110397
Office:
Contract #: DAAH0191CR277
PI: EDWARD FRANCO
Title: X-RAY MICROLITHOGRAPHY COLLIMATOR DEVELOPMENT
Abstract: DARPA AND THE U.S. SEMICONDUCTOR COMMUNITY ARE ACTIVELY DEVELOPING LASER-PRODUCED PLASMA (LPP) X-RAY SOURCES AS THE BASIS FOR X-RAY MICROLITHOGRAPHY EXPOSURE SYSTEMS. THESE LPP SOURCES WILL ALLOW THE CONSTRUCTION OF COMPACT EXPOSURE SYSTEMS THAT CAN BE EASILY INTEGRATED INTO EXISTING SEMICONDUCTOR FABRICATION LINES, AT A COST SUBSTANTIALLY LESS THAN THAT OF COMPARABLE SYNCHROTRON EXPOSURE BEAM-LINES. IT IS GENERALLY AGREED THAT AN LPP-BASED EXPOSURE SYSTEM MUST INCORPORATE A PARABOLOIDAL SOFT X-RAY COLLIMATOR OPTIC TO COMPENSATE FOR BEAM DIVERGENCE THAT WOULD OTHERWISE DEGRADE THE ABILITY OF THE SYSTEM TO REPLICATE SUB-MICRON LINE FEATURES. THE GOAL OF THE PROPOSED PHASE I PROJECT IS TO CALCULATIONALLY AND EXPERIMENTALLY EVALUATE THE FEASIBILITY OF COLLIMATOR MANUFACTURING INNOVATIONS THAT IMPROVE THE RADIATION TRANSPORT EFFICIENCY AND REDUCE THE REPLICATION COST OF THE COMPONENTS. THIS WILL SET THE STAGE FOR THE CONSTRUCTION AND EVALUATION OF OPTIMIZED LPP X-RAY COLLIMATOR PROTOTYPE UNITS IN PHASE II OF THE PROJECT. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - A SUCCESSFUL PROJECT WILL PROVIDE TO THE U.S. SEMICONDUCTOR INDUSTRY A PRACTICAL, EFFICIENT, AND COST-EFFECTIVE MEANS FOR IMPLEMENTING NEXT-GENERATION X-RAY CONTACT MICROLITHOGRAPHY EXPOSURE TECHNIQUES. IT WILL ADDITIONALLY SET IN PLACE AN ADVANCED X-RAY OPTICS TECHNOLOGY THAT SUPPORTS FOLLOWING-GENERATION PROJECTION MICROLITHOGRAPHY TECHNIQUES.

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Topic#: 91-236 ID#: 9120062
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Contract #: DAAH0192CR018
PI: JOHN DUBOIS
Title: PORTABLE METEOROLOGICAL DIGITAL DOWNLINK TERMINAL
Abstract: A SYSTEM DESIGN IS PROPOSED FOR A LOW COST MAN-PORTABLE SATELLITE DIRECT DOWNLINK TERMINAL TO RECEIVE DIGITAL TRANSMISSIONS FROM TIROS-N, GOES, METEOSAT AND DMSP WEATHER SATELLITES. KEY AREAS OF ENABLING TECHNOLOGY ARE IDENTIFIED AND DISCUSSED. IN PHASE I, ASDC WILL DEVELOP AND BREADBOARD SUFFICIENT HARDWARE AND SOFTWARE TO DEMONSTRATE A WORKING PROOF OF CONCEPT SYSTEM. SPECIFICATIONS AND HARDWARE DEVELOPMENT REQUIRED FOR A FULL PHASE II PROTOTYPE WILL BE DETAILED IN THE FINAL REPORT. THIS TERMINAL WILL PERMIT DIRECT FIELD RECEPTION OF HIGH RESOLUTION DIGITAL IMAGE DATA FROM WEATHER SATELLITES. THE

METEOROLOGICAL UTILITY OF THE DATA WILL BE ENHANCED FOR MILITARY AND CIVILIAN APPLICATIONS BY MORE TIMELY AVAILABILITY AND DIRECT USER ACCESS TO FULL DATA SETS.

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Topic#: 91-055 ID#: 9110411
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Contract #: DAAH0191CR159
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Title: HTSC CHANNELIZED RECEIVER
Abstract: RECENT ADVANCES IN HIGH TEMPERATURE SUPERCONDUCTING (HTSC) THIN FILM TECHNOLOGY ENABLE THE FABRICATION OF LOW-LOSS COMPONENTS THAT WILL IMPROVE THE COST AND PERFORMANCE OF CHANNELIZED RECEIVERS. CHANNELIZED RECEIVERS ARE USED IN SATELLITE TRANSPONDER, ELECTRONIC WARFARE AND ELECTRONICS INTELLIGENCE APPLICATIONS AND ARE COMPRISED OF A GROUP OF NARROW BAND RECEIVERS THAT COVER INDIVIDUAL SLOTS IN A CONTINUOUS FREQUENCY PLAN. EACH RECEIVER REQUIRES ITS OWN COMPACT, NARROW BAND, LOW LOSS AND HIGHLY SELECTIVE FILTER(S). UNFORTUNATELY, WHEN PHYSICAL LOSS IS PRESENT THESE REQUIREMENTS ARE ESSENTIALLY MUTUALLY EXCLUSIVE LEADING TO SIGNIFICANT COMPROMISES IN TRADITIONAL DESIGNS. LOW LOSS SUPERCONDUCTING THIN FILMS DEPOSITED ON LOW DIELECTRIC CONSTANT SUBSTRATES PRESENT THE OPPORTUNITY TO BREAK THROUGH THE TRADITIONAL LIMITATIONS OF FILTER DESIGN; MAJOR REDUCTIONS IN SIZE, LOSS AND COST ARE NOW POSSIBLE. THE POTENTIAL OF HTSC COMPONENTS TO IMPROVE THE PERFORMANCE OF LUMPED ELEMENT FILTERS WILL BE EVALUATED IN PHASE I BY A TEAM LED BY ADVANCED TECHNOLOGY MATERIALS, A LEADER IN HTSC MATERIALS FABRICATION AND DEVICE PROCESSING. WATKINS JOHNSON WILL DESIGN AND ANALYZE THE FILTER ELEMENTS. DURING PHASE II, A PROTOTYPE CHANNELIZED RECEIVER T1BACACUO FILTER BANK WILL BE BUILT AND TESTED AND A COST ESTIMATE FOR FULL-UP SYSTEM DEMONSTRATION WILL BE DEVELOPED. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE INNOVATIVE CHANNELIZED RECEIVERS WILL ACHIEVE PERFORMANCE AND COST ADVANTAGES IN HIGH FREQUENCY COMMUNICATION, RADAR AND ELECTRONIC WARFARE SYSTEMS. LOW LOSS, NARROW BANK HTSC FILTERS WILL ENHANCE THE PERFORMANCE OF THE ASSOCIATED CHANNELIZED RECEIVERS FOR SATELLITE TRANSPONDERS AND EW ELECTRONIC SUPPORT MEASURES.

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Topic#: 91-055 ID#: 9110550
Office:
Contract #: DAAH0191CR224
PI: PETER KIRLIN
Title: HTSC RECEIVE PHASED ARRAY ANTENNA
Abstract: SIGNIFICANT SIMPLIFICATION OF MICROWAVE PHASED ARRAY ANTENNA SYSTEM ARCHITECTURES CAN BE ACHIEVED WITH HTSC DEVICE TECHNOLOGY. ELIMINATION OF THE LOW NOISE AMPLIFIERS (LNAS) CAN BE ACCOMPLISHED THROUGH REPLACEMENT OF THE GAAS PHASE SHIFTERS WITH LOW LOSS HTSC COMPONENTS. A REDUCTION IN COMPLEXITY LOWERS BOTH SYSTEM WEIGHT AND COST. KEY TO HTSC TECHNOLOGY INSERTION IN PHASED ARRAY ANTENNAS IS THE DEVELOPMENT OF A NOVEL MULTIPLE BIT HTSC PHASE SHIFTER. PHASE I FOCUSES ON THE DEMONSTRATION OF A LOW LOSS HTSC SWITCH (THE CRITICAL COMPONENT OF THE HTSC PHASED ARRAY SYSTEM) AND THE EVALUATION OF THEORETICAL HTSC PHASED ARRAY ANTENNA SYSTEM DESIGNS FOR DIRECT INSERTION INTO EXISTING OR NEXT-GENERATION PLATFORMS. IN PHASE II THE HTSC PHASE SHIFTER WILL BE BUILT AND TESTED, A SPECIFIC SYSTEM FOR INSERTION WILL BE IDENTIFIED, THE HTSC PHASED ARRAY ANTENNA SYSTEM WILL BE DESIGNED, AND ESTIMATES OF THE DEVELOPMENT AND DEMONSTRATION COSTS WILL BE FINALIZED. SYSTEMS INSERTION WILL BE ACCELERATED THROUGH CLOSED INTERACTION BETWEEN ATM, A LEADER IN THE PRODUCTION OF LOW SURFACE RESISTIVITY HTSC FILMS AND HIGH Q MICROWAVE DEVICES, AND THE HARRIS CORPORATION, A SYSTEMS INTEGRATOR WELL KNOWN FOR ITS WORK ON PHASED ARRAY ANTENNAS. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE PROPOSED HTSC PHASE SHIFTER DEVICE TECHNOLOGY HAS THE POTENTIAL TO BE UTILIZED IN BOTH MILITARY AND

CIVILIAN MICROWAVE SYSTEMS. DEVELOPMENT OF HTSC-BASED RECEIVE PHASED ARRAY ANTENNA SYSTEMS IN ADVANCED HIGH FREQUENCY COMMUNICATION, RADAR AND ELECTRONIC WARFARE SYSTEMS WILL ACHIEVE BOTH PERFORMANCE AND COST ADVANTAGES RELATIVE TO CONVENTIONAL ANTENNA SYSTEMS.

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Phone: (508) 256-4950
Topic#: 91-068 ID#: 9110529
Office:
Contract #: DAAH0192CR185
PI: H. LIN
Title: AUTOMATIC TARGET RECOGNITION SYSTEM USING DISTRIBUTED MULTIPLE SENSORS
Abstract: THIS PROPOSED RESEARCH IS INVOLVED IN DESIGNING SYSTEMS CAPABLE OF AUTOMATIC TARGET RECOGNITION (ATR) IN HOSTILE ENVIRONMENTS. SPECIAL NOTE IS MADE OF THE UNIQUE ASPECTS OF ATR IN RELATION TO THE GENERAL PROBLEM OF OBJECT RECOGNITION AS STUDIED IN PATTERN RECOGNITION AND COMPUTER VISION. RESEARCH IS THEN PROPOSED THAT INVOLVES THE DEVELOPMENT OF AN ATR TECHNIQUE FOR USE IN GROUND-TO-GROUND OPERATION SCENARIO USING DISTRIBUTED SENSOR PLATFORMS, EACH CONTAINING A SUITE OF COMPLEMENTARY SENSORS. RESEARCH EFFORTS TO BE EMPHASIZED IN THIS PROPOSED RESEARCH PROJECT INCLUDE: 1) DEVELOP A HIERARCHICAL 3-D MULTIVIEW REPRESENTATION SCHEME TO MODEL TARGETS SO THAT THEY CAN BE EFFICIENTLY RECOGNIZED USING SENSOR PLATFORMS DISTRIBUTED OVER A COMMON GEOGRAPHICAL AREA; 2) DEVELOP AND EVALUATE MULTISENSOR INTEGRATION/FUSION PARADIGMS AT THE SIGNAL, PIXEL, FEATURE AND SYMBOL LEVEL; 3) DEVELOP A STAND-ALONE HIERARCHICAL MULTI-PROCESSOR COMPUTER SYSTEM TO SUPPORT REAL-TIME OPERATION OF AN INTELLIGENT MOBILE SENSOR PLATFORM. IN THE PHASE I EFFORT, SIMULATIONS ARE USED TO DEMONSTRATE HOW THIS TECHNIQUE CAN IMPROVE OVERALL TARGET RECOGNITION ACCURACY AS COMPARED TO THE USE OF JUST A SINGLE SENSOR OR A SUITE OF SENSORS MOUNTED ON A SINGLE PLATFORM. THE SIMULATIONS INCLUDE A VARIETY OF GROUND-BASED TARGETS THAT ARE PRESENTED IN A NUMBER OF CONFIGURATIONS AND UNDER DIFFERENT OPERATING CONDITIONS. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE FEASIBILITY STUDY OF THE PROPOSED PHASE I EFFORT IS TO PROVIDE A SOLUTION TO THE KEY ISSUES FOR AN EFFECTIVE AUTOMATIC TARGET RECOGNITION SYSTEM FOR MILITARY APPLICATIONS. THE RESEARCH RESULTS COULD BE ADAPTED FOR USE IN A VARIETY OF COMMERCIAL APPLICATIONS.

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Phone: (508) 663-9500
Topic#: 91-067 ID#: 9110234
Office:
Contract #: DAAH0191CR194
PI: PAUL KEBABIAN
Title: LASER BASED METHYL RADICAL MONITORING FOR PROCESS CONTROL IN DIAMOND CVD DEPOSITION
Abstract: THE METHYL RADICAL IS A KEY SPECIES IN THE FORMATION OF CVD DIAMOND, FOR WHICH THERE IS A NEED FOR AN ON-LINE MONITOR USABLE IN INDUSTRIAL PRODUCTION OF CVD DIAMOND. WE PROPOSE TO MONITORMETHYL RADICAL CONCENTRATIONS USING THE ABSORPTION OF THE INFRARED OUTPUT OF A NEUTRAL XENON LASER AT 3217.75 WAVENUMBERS. THE PHASE I EXPERIMENTS WILL MEASURE THIS ABSORPTION IN AN RF METHANE PLASMA, IN WHICH METHYL RADICAL CONCENTRATION IS MEASURED USING A PREVIOUSLY CALIBRATED ABSORPTION LINE NEAR 608 WAVENUMBERS. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE PROPOSED METHYL RADICAL MONITOR WOULD BE USED FOR ON-LINE QUALITY CONTROL OF THE DIAMOND DEPOSITION PROCESS. USING OTHER LASER LINES, A SIMILAR MONITOR COULD BE USED FOR OTHER MOLECULAR SPECIES.

AETECH, INC.
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SOLANA BEACH, CA 92075
Phone: (619) 755-1277
Topic#: 91-210 ID#: 9120183
Office: SSTO
Contract #: DAAH0192CR135
PI: JAMES THOMES

Title: DOMAIN SPECIFIC SOFTWARE ARCHITECTURE ADA REUSABLE SOFTWARE ASSETS (INFORMATION SYSTEMS DOMAIN)

Abstract: AETECH, A LEADER IN ADA ENVIRONMENTS AND TOOLS, A STARS CONTRACTOR SINCE ITS INCEPTION, AND THE ADA9X CONTRACTOR FOR THE INFORMATION SYSTEMS DOMAIN PROPOSES TO DESIGN AND DEVELOP A SOFTWARE ARCHITECTURE FOR THE INFORMATION SYSTEMS DOMAIN. IN PHASE I, AETECH WILL ANALYZE THE REQUIREMENTS AND MARKET POTENTIAL OF THE DOMAIN AND PROVIDE A DETAILED SPECIFICATION FOR A SOFTWARE ARCHITECTURE WHICH MAY BE USED AS A BASIS FOR STARS AND THE DEVELOPMENT OF COMMERCIAL REUSABLE SOFTWARE. THIS SOFTWARE ARCHITECTURE, REFERRED TO IN THIS PROPOSAL AS THE INFORMATION SYSTEMS SOFTWARE ARCHITECTURE (ISSA), WILL BE DEVELOPED AS AN INSTANCE OF THE DOMAIN SPECIFIC SOFTWARE ARCHITECTURE (DSSA). THE PHASE I PRODUCT WILL BE DELIVERED AS A REQUIREMENTS ANALYSIS, OF THE MARKET POTENTIAL FOR REUSABLE SOFTWARE ASSETS, A HIGH-LEVEL DESIGN FOR THE ARCHITECTURE, A DETAILED DESIGN COMPRISED OF A SET OF ADA SPECIFICATIONS FOR THE COMPONENTS, AND A USERS MANUAL DESCRIBING ITS PRINCIPLES OF OPERATION, RULES FOR USE, AND INTERFACES TO COMMON HARDWARE, PERIPHERALS, AND BINDINGS OF DOD INFORMATION SYSTEMS. IN PHASE II, AETECH WILL REFINE THE SYSTEM TO THE SPECIFICATIONS OF STARS, DEVELOP A COMMERCIAL QUALITY SOFTWARE SYSTEM, AND ESTABLISH AN OFFICE IN MORGANTOWN, WEST VIRGINIA, TO ASSIST IN INTEGRATING THE ISSA WITH THE ASSET REPOSITORY. ADA HAS RECENTLY BEEN MANDATED FOR THE INFORMATION SYSTEM DOMAIN, BUT ADA WAS ORIGINALLY DESIGNED FOR EMBEDDED SYSTEMS, NOT INFORMATION SYSTEMS, AND THERE IS AN IMPORTANT NEED TO ESTABLISH A SOFTWARE ARCHITECTURE FOR REUSABLE CODE IN THIS AREA. THIS PROJECT, ENTITLED INFORMATION SYSTEMS SOFTWARE ARCHITECTURE(ISSA) ESTABLISHES THE BASIS FOR SOFTWARE DEVELOPMENT IN THIS DOMAIN.

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Topic#: 91-214 ID#: 9120185
Office: SSTO
Contract #: DAAH0192CR132
PI: JAMES THOMES

Title: SOFTWARE TOOLS TO IMPROVE THE INTERACTION BETWEEN THE BUYERS AND SUPPLIERS OF NON OFF-THE-SHELF SOFTWARE

Abstract: AETECH, A NATIONAL LEADER IN ADA ENVIRONMENTS AND TOOLS, PROPOSES TO DESIGN AND DEVELOP A COMMERCIAL-QUALITY SOFTWARE APPLICATION COMPRISED OF SOFTWARE TOOLS WHICH WILL IMPROVE THE INTERACTION BETWEEN THE BUYERS AND SUPPLIERS OF NON OFF-THE-SHELF ADA SOFTWARE. IN PHASE I, AETECH WILL PROVIDE A DETAILED SPECIFICATION OF THE NEW TECHNOLOGY WHICH WILL INCLUDE ACQUIRING, MOVING AND DISPLAYING DOCUMENTATION FROM ASSET AND OTHER DOD SOURCES, ASSISTING THE GOVERNMENT IN PROVIDING AND USING THE REUSABLE ADA SOFTWARE IN ASSET, ARID ASSISTING THE SOFTWARE DEVELOPER IN INTEGRATING THE STARS SOFTWARE ASSETS INTO BIDS FOR NEW DOD SOFTWARE. IN PHASE I, AETECH WILL ALSO DELIVER A SUBSET PROTOTYPE OF THE SYSTEM CONSISTING OF AN INTEGRATED ENVIRONMENT ENTITLED THE SOFTWARE ACQUISITION AND VALUATION ENVIRONMENT (SAVE), WHICH WILL RUN ON STANDARD MILITARY MICROCOMPUTERS SUCH AS THE ZENITH Z-248, UNISYS DESKTOP III, AND THE NEW DESKTOP IV. IN PHASE II, THE SAVE WILL BE DEVELOPED, REFINED, PRODUCTIZED AND INTEGRATED INTO THE STARS ASSET REPOSITORY IN MORGANTOWN, VA. IN OPERATIONAL PRACTICE, THIS SYSTEM SHOULD SIGNIFICANTLY REDUCE THE COST OF DEVELOPING NEW SYSTEMS WITH REUSABLE ADA SOFTWARE. HUNDREDS OF THOUSANDS OF LINES OF REUSABLE ADA SOFTWARE NOW EXIST, BUT THERE IS LITTLE EVIDENCE THAT THE COST OF SOFTWARE DEVELOPMENT HAS BEEN REDUCED, BECAUSE NO VALUE IS PLACED ON THIS CODE IN THE ACQUISITION PROCESS. THIS SYSTEM WILL HELP MANAGERS, CONTRACT MANAGERS, AND SOFTWARE DEVELOPERS ACHIEVE QUICK, TANGIBLE, MEASURABLE BENEFITS FROM THE USE OF ADA.

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Topic#: 91-239 ID#: 9120091
Office: UWO
Contract #: DAAH0192CR004

Phone: (201) 962-4480 PI: O. ADLHART
Title: LOAD RESPONSIVE HYDROGEN GENERATOR FOR UUV APPLICATION
Abstract: A PROGRAM FOR THE DEVELOPMENT OF A HYDROGEN GENERATOR FOR USE WITH PEM FUEL CELLS IN UUV APPLICATIONS IS PROPOSED. HYDROGEN IS GENERATED BY REACTING ALKALI AND ALKALI-EARTH METAL HYDRIDES WITH WATER. PURE HYDROGEN AND ALKALI-ALKALI EARTH METAL OXIDES OR HYDROXIDES ARE FORMED. ENERGY DENSITIES MAY EXCEED 1KWHR/LB OF REACTANTS. GENERATION IS NOT AFFECTED BY VEHICLE POSITION OR MOTION. THE PROPOSED DEVELOPMENT ADDRESSES: 1. THE PROBLEM OF UNIFORMITY AND COMPLETENESS OF REACTANT UTILIZATION. 2. CONTROL OF HYDROGEN GENERATION RATE (LOAD RESPONSIVE GENERATION). 3. VOLUME EXPANSION OF SOLID REACTANTS. 4. DISSIPATION OF REACTION HEAT. THE SOLID HYDRIDE REACTANT IS DISTRIBUTED FOR THIS PURPOSE IN A CARTRIDGE OF CORRUGATED AND PERFORATED SHEET METAL. STRANDS OF WICKING MATERIAL ARE PLACED IN CONTACT OF THE HYDRIDE AND WICKING PADS PLACED ON EITHER SIDE OF THE ASSEMBLY. THE CARTRIDGE IS PLACED IN A PRESSURE VESSEL. WATER IS METERED TO THE VESSEL AND DISTRIBUTED RAPIDLY BY WICKING THROUGHOUT THE CARTRIDGE GENERATING HYDROGEN AS REQUIRED BY THE LOAD (LOAD RESPONSIVE). IN ADDITION, WATER IS VAPORIZED BY THE HEAT GENERATED IN THE REACTION AND CONDENSED ON THE REACTOR WALLS OR COOLING COILS BEFORE BEING RECYCLED BY WICKING. THE VOLUME EXPANSION TAKING PLACE DURING THE CONVERSION IS TAKEN UP BY THE CORRUGATED SHEET METAL STRUCTURE. THE HYDROGEN GENERATOR TO BE DEVELOPED UNDER THE PROPOSED PROGRAM, IF COMBINED WITH PEM FUEL CELLS FOR POWER GENERATION, OFFERS ENERGY DENSITIES SUBSTANTIALLY SUPERIOR TO BATTERIES IN UUV AND HAND OR MAN PORTABLE APPLICATIONS.

ALDEN ELECTRONICS, INC. Topic#: 91-236 ID#: 9120740
40 WASHINGTON STREET Office: ASTO
WESTBOROUGH, MA 01581 Contract #: DAAH0192CR136
Phone: (508) 366-8851 PI: JOHN NUBER
Title: LOW-COST, MAN-PORTABLE REAL-TIME WEATHER SATELLITE DATA RECEIVING, PROCESSING AND DISPLAY TECHNOLOGY
Abstract: THIS STUDY WILL DEVELOP A SYSTEM CONFIGURATION FOR A REAL-TIME WEATHER SATELLITE TERMINAL THAT IS LOW-COST AND MAN-PORTABLE. LOW-COST IMPLIES COMMERCIAL OFF THE SHELF. COSTS CAN BE MINIMIZED BY MAXIMIZING THE USE OF PRODUCTS AND/OR COMPONENTS THAT ARE ALREADY COMMERCIALLY AVAILABLE. LIFE CYCLE COSTS CAN BE MINIMIZED BY UTILIZING AN OPEN ARCHITECTURE WITH INDUSTRY STANDARD INTERFACES. MAN-PORTABLE IMPLIES LIGHT WEIGHT AND LOW POWER. SURVIVABILITY IN AN UNCONTROLLED ENVIRONMENT IS A DESIGN GOAL IN THE COURSE OF THIS STUDY WE WILL DEVELOP A SYSTEMS CONCEPT THAT MEETS THESE OBJECTIVES BY FIRST ESTABLISHING THE SYSTEM LEVEL REQUIREMENTS IMPLIED BY EACH OF THE POSSIBLE WEATHER SATELLITE SIGNAL SOURCES; POLAR ORBITING; ANALOG (APT), DIGITAL (HRPT), OTHER (TOVS); GEOSYNCHRONOUS; ANALOG (WEFAX), DIGITAL (VISSR), OTHER (MDD). THESE REQUIREMENTS WILL THEN BE ALLOCATED TO THE 4 MAJOR SUBSYSTEMS: 1) ANTENNA SUBSYSTEM, 2) RECEIVER SUBSYSTEM WITH PREPROCESSOR, 3) POWER SUBSYSTEM, AND 4) PROCESSING/DISPLAY/STORAGE SUBSYSTEM. THE RECEIVER (2) AND PROCESSING (4) SUBSYSTEMS FORM ONE 40 POUND PACKAGE WHILE THE POWER SYSTEM (3) FORMS ANOTHER 40 POUND PACKAGE. THESE CAN BE CARRIED ONE IN EACH HAND WHILE THE ANTENNA (1) COLLAPSES INTO A PACKAGE SMALL ENOUGH TO BE CARRIED ON THE BACK. THIS SYSTEM COULD BE USED AT FIELD LOCATIONS WORLDWIDE TO RECEIVE METEOROLOGICAL DATA FROM SATELLITES AND WOULD MAKE IT POSSIBLE FOR ADVANCED FORCES TO CARRY THEIR WEATHER SATELLITE RECEIVING CAPABILITY WITH THEM INTO THE FIELD. FOR A COMMERCIAL MARKETPLACE A SIMPLE, LIGHTWEIGHT AND RUGGED SYSTEM WOULD SUPPORT NON DEFENSE USES SUCH AS THE U.S. FIRE SERVICE, BUREAU OF LAND MANAGEMENT, AND THE COAST AND GEODETIC SURVEY. PERHAPS THE GREATEST POTENTIAL IS IN UNDERDEVELOPED COUNTRIES FOR PROTECTION OF LIFE AND PROPERTY AND THE SUPPORT AND DEVELOPMENT OF AGRICULTURE, AS WELL AS VARIOUS INFRASTRUCTURES, IE: ROADS, HARBORS, ETC.

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Topic#: 91-113 ID#: 9121039
Office: MTO
Contract #: DAAH0192CR162
PI: NILS SANDELL JR.
Title: NEURAL NETWORKS APPLIED TO GAAS PROCESS CONTROL
Abstract: THE OBJECTIVE OF THE PHASE I RESEARCH EFFORT WILL BE TO DEMONSTRATE THE FEASIBILITY OF USING GAAS CRYSTAL RADIUS ESTIMATES, OBTAINED BY APPLYING NEURAL NETWORK TECHNIQUES TO PROCESS VIDEO IMAGERY, FOR REAL TIME CONTROL OF THE LIQUID-ENCAPSULATED CZOCHRALSKI (LEC) PROCESS. A CRYSTAL RADIUS ESTIMATE IS ESSENTIAL FOR IMPROVED PROCESS CONTROL BECAUSE THE CURRENTLY UTILIZED MEASUREMENT HAS AN ANOMALOUS, NON-MINIMUM PHASE BEHAVIOR THAT LIMITS CONTROL SYSTEM PERFORMANCE. NEURAL NETWORK TECHNIQUES ARE APPROPRIATE FOR COMPUTING THIS ESTIMATE BECAUSE OF THE COMPLEXITY OF THE CRYSTAL IMAGES AND THE AVAILABILITY OF TRAINING DATA. FEASIBILITY WILL BE DEMONSTRATED BY DIGITIZING VIDEO IMAGERY AND CORRESPONDING RADIUS MEASUREMENTS OBTAINED FROM THE GE CORPORATE RESEARCH AND DEVELOPMENT CENTER TO PROVIDE TRAINING AND TEST DATA SETS, SELECTING ONE OR MORE CANDIDATE MULTI-LAYER PERCEPTION (MLP) MODELS, TRAINING THE MODEL(S) TO PERFORM THE NONLINEAR MAPPING BETWEEN THE (PREPROCESSED) IMAGES AND THE CRYSTAL RADIUS, AND EVALUATING THE PERFORMANCE OF THE RADIUS ESTIMATOR FOR DATA NOT INCLUDED IN THE TRAINING SET. ESTIMATION ACCURACY WILL BE ASSESSED BASED ON THE REQUIREMENTS FOR CLOSED-LOOP CONTROL. ASSUMING THAT ESTIMATION ACCURACY IS SATISFACTORY, THE ABILITY TO ACHIEVE REAL-TIME PROCESSING WILL ALSO BE EVALUATED. IMPROVED, INTELLIGENT PROCESS CONTROL OF THE LEC PROCESS CAN REDUCE MATERIAL WASTAGE BY PROVIDING TIGHTER RADIUS CONTROL AND MORE RAPID DETECTION OF THE ONSET OF MULTI-CRYSTALLINE GROWTH. IT CAN REDUCE REQUIREMENTS FOR OPERATOR MONITORING AND POTENTIALLY PROVIDE MATERIAL WITH IMPROVED ELECTRICAL PROPERTIES. ALTHOUGH THE FOCUS OF THE RESEARCH WILL BE ON GROWTH OF GAAS CRYSTALS, THE TECHNOLOGY DEVELOPED WILL BE APPLICABLE TO OTHER MATERIALS AS WELL, E.G., INDIUM PHOSPHIDE.

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Topic#: 91-161 ID#: 9120686
Office: ESTO
Contract #: DAAH0192CR005
PI: RICHARD KETCHPEL
Title: HIGH EFFICIENCY COLOR LCD BACKLIGHT
Abstract: BACKLIGHTS FOR PORTABLE COLOR LCD MATRIX DISPLAYS ARE EXTREMELY INEFFICIENT: 96% OF THE BATTERY POWER IS WASTED ON THE BACKLIGHT SYSTEM. A HIGH EFFICIENCY BACKLIGHT SYSTEM IS PROPOSED BASED ON THE USE OF MICRO-OPTICAL IMAGING OF RGB PHOSPHOR TRIADS ONTO THE LCD RGB PIXEL ROWS SO THAT THE 67% LOSS IN THE LCD FILTER SYSTEM IS AVOIDED. IN ADDITION A SPECIAL COLLIMATOR IS PROPOSED THAT CONCENTRATES THE EMISSION INTO THE ACCEPTANCE CONE OF THE LCD DISPLAY. USE OF HIGH EFFICIENCY RGB PHOSPHOR (95% CONVERSION EFFICIENCY) COUPLED WITH THE COLLIMATION OPTICS SHOULD RESULT IN A 12X INCREASE IN EFFICIENCY OVER EXISTING LCD COLOR BACKLIGHTS. THIS DEVELOPMENT COULD HAVE MAJOR IMPACT ON COMMERCIAL PORTABLE COMPUTER TERMINALS PARTICULARLY WITH COLOR DISPLAYS IN WHICH CASE THE TIME BETWEEN BATTERY RE-CHARGE COULD BE GREATLY INCREASED OR THE SIZE AND WEIGHT OF THE BATTERY REDUCED.

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Phone: (716) 631-0181
Topic#: 91-109 ID#: 9120825
Office: DSO
Contract #: DAAH0192CR006
PI: CESAR BANDERA
Title: BIOLOGICAL SIGNAL PROCESSING: MULTIACUITY VISION
Abstract: A FUNDAMENTAL PROBLEM IN MACHINE VISION FOR DYNAMIC SCENARIO APPLICATIONS IS THE TRADE-OFF BETWEEN SENSOR FIELD-OF-VIEW (FOV), SENSOR ACUITY, AND THE OVERWHELMING AMOUNT

OF SENSOR DATA WHICH MUST BE PROCESSED, LIMITING OVERALL SYSTEM, PERFORMANCE. TYPICALLY, FEATURES TO BE RESOLVED IN A SCENE ARE LOCALIZED WITHIN THE FOV. UNIFORM SAMPLING WITHIN THE FOV IS THUS INAPPROPRIATE; REGIONS WITH LITTLE OR NO RELEVANCE TO THE TASK ARE SAMPLED AT THE SAME RESOLUTION AS KEY FEATURES, OCCUPYING VALUABLE SIGNAL BANDWIDTH AND COMPUTATIONAL RESOURCES, AND INCREASING SYSTEM LATENCIES. THE DEVELOPMENT OF A NEW CLASS OF MACHINE VISION SYSTEMS, CALLED FOVEAL SYSTEMS, IS PROPOSED. FOVEAL SYSTEMS FEATURE IMAGING SENSORS AND SIGNAL PROCESSING WITH GRADED ACUITY COUPLED WITH CONTEXT SENSITIVE SENSOR GAZE CONTROL, ANALOGOUS TO THAT PREVALENT THROUGHOUT VERTEBRATE VISION. FOVEAL SYSTEMS OPERATE MORE EFFICIENTLY THAN UNIFORM ACUITY SYSTEMS BECAUSE RESOLUTION IS TREATED AS A DYNAMICALLY ALLOCATABLE RESOURCE. TI-IIS PERMITS A SIMULTANEOUS WIDE FOV AND HIGH ACUITY, WHILE MINIMIZING SENSOR DATA TO ONLY THAT WHICH IS RELEVANT. THE DEVELOPMENT OF ADVANCED FOVEAL MACHINE VISION TECHNIQUES IS PROPOSED FOR PHASE I BY IMPLEMENTING PREATTENTIVE AND ATTENTIVE BIOLOGICAL TECHNIQUES, AND ADAPTING UNIFORM ACUITY MACHINE TECHNIQUES. FOVEAL TECHNIQUES INCLUDE HIERARCHICAL KNOWLEDGE REPRESENTATION AND DATA STRUCTURE-MULTIPROCESSOR DESIGN, ADVANCED GAZE CONTROL, AND VARIABLE ACUITY FEATURE EXTRACTION. FOVEAL SYSTEMS OFFER IMPROVED VISION PERFORMANCE, GREATER PLATFORM INTELLIGENCE AND AUTONOMOUS OPERATION, AND LOWER SYSTEM COST. FOVEAL SYSTEMS INTERROGATE TARGETS WITH HIGH RESOLUTION TO REDUCE AMBIGUITIES AND CLASSIFICATION FALSE ALARM RATES, WHILE SUPPORTING A WIDE FOV WHICH IMPROVES MULTITARGET DETECTION AND TRACK CORRELATION. FOVEAL MACHINE VISION SYSTEMS FEATURE ORDERS OF MAGNITUDE LESS COMPUTATIONAL LATENCY AND HARDWARE THAN UNIFORM ACUITY SYSTEMS WITH THE SAME MAXIMUM RESOLUTION AND FOV.

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Topic#: 91-087 ID#: 9120186
Office: NMRO
Contract #: DAAH0192CR081
PI: JAMES WALKER

Title: MAGNETIC DIPOLE RADIATION GENERATED IN AN UNDERGROUND NUCLEAR EXPLOSION: A METHOD FOR MEASURING YIELD

Abstract: BOTH ATMOSPHERIC AND HIGH-ALTITUDE NUCLEAR EXPLOSIONS WILL PRODUCE MAGNETIC SIGNALS THAT ARE DETECTABLE OVER VERY LARGE DISTANCE. AN UNDERGROUND EXPLOSION WILL ALSO PRODUCE A MAGNETIC SIGNAL, BUT IT IS DETECTABLE AT MUCH SMALLER DISTANCE. THIS IS BECAUSE THE UNDERGROUND FIREBALL IS INERTIALLY TAMPED BY THE MORE DENSE EARTH, AND BECAUSE THE LOW FREQUENCY ELECTROMAGNETIC WAVE IS STRONGLY ATTENUATED BY THE EARTH. THIS PROPOSAL DESCRIBES: A) A CLASSICAL ELECTROMAGNETIC FORMALISM FOR QUANTITATIVE UNDERSTANDING THE NATURE OF THE UNDERGROUND MAGNETIC EFFECT; AND B) A MEANS OF ABSOLUTE TIME-DEPENDENT UNDERGROUND FIREBALL VOLUME MEASUREMENT. JUST AS WITH ATMOSPHERIC FIREBALL MEASUREMENTS, UNDERGROUND FIREBALL VOLUME IS DIRECTLY PROPORTIONAL TO EXPLOSIVE YIELD. THIS PROJECT ADDRESSES THE NEED TO DEVELOP A BETTER YIELD DETERMINATION TECHNIQUE FOR CONTAINED UNDERGROUND NUCLEAR EXPLOSIONS. IT WILL BE EMPLOYED BY ON-SITE TEAMS OF U.S. AND COOPERATING TREATY SIGNATORIES TO MONITOR TREATY LIMITS. IT HAS NO MAJOR COMMERCIAL POTENTIAL AS YET, BUT CONCEIVABLY COULD BE APPLIED TO EARTHQUAKE RESEARCH.

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Topic#: 91-002 ID#: 9110282
Office:
Contract #: DAAH0191CR281
PI: PHILLIP WASSERMAN

Title: NEURAL NETWORK IMAGE RECOGNITION USING ACOUSTIC CHARGE TRANSPORT DEVICES

Abstract: THIS FEASIBILITY PROJECT WILL DEFINE, DESIGN AND PROVE RELEVANT CONCEPTS ON THE USE OF ACOUSTIC CHARGE TRANSPORT (ACT)TECHNOLOGY FOR IMPLEMENTING NEURAL-NETWORK BASED IMAGE TARGET RECOGNITION. ACT IS THE ONLY TECHNOLOGY AVAILABLE TODAY WHICH PROMISES A

LEVEL OF PERFORMANCE EQUIVALENT TO 46 BILLION MULTIPLY-ADDS PER SECOND ON A SINGLE IC CHIP. THE PROPOSED SYSTEM MAY BE CAPABLE OF VERY HIGH THROUGHPUT, UP TO 200 MILLION PIXELS PER SECOND, TYPICAL OF SYNTHETIC APERTURE RADAR AND LASER BASED IMAGE DETECTION SYSTEMS. WE WILL INVESTIGATE VARIOUS NEURAL NETWORK MODELING PARADIGMS, CONFIGURE AN ACT DEVICE TO PERFORM THE NEURAL NETWORK MODELING OF SCANNED IMAGERY AND DEVELOP WHATEVER NECESSARY ADDITIONAL SOFTWARE AND HARDWARE FOR THIS TASK. IF SUCCESSFUL, WE WILL HAVE CREATED THE WORLD'S FASTEST NON-OPTICAL NEURAL NET PATTERN RECOGNIZER OF RASTER SCANNED IMAGES. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE PRIMARY BENEFIT WE EXPECT TO ATTAIN IS AN ASSESSMENT OF HOW WELL ACT TECHNOLOGY CAN PERFORM NEURAL-NETWORK BASED IMAGE PROCESSING AT EXTREMELY HIGH SPEED, SUITABLE FOR SYNTHETIC APERTURE RADAR AND LASER BASED TARGET RECOGNITION.

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Topic#: 91-055
Office:
Contract #: DAAH0191CR189
PI: M. KHAN

ID#: 9110572

Title: METALORGANIC ATOMIC LAYER EPITAXY FOR YBACUO SIS DETECTOR FABRICATION

Abstract: THIS PROPOSAL DESCRIBES A PHASE I PROGRAM AIMED AT DEVELOPING SUPERCONDUCTOR INSULATOR SUPERCONDUCTOR (SIS) DETECTORS IN THIN FILMS OF YBACUO DEPOSITED ON SRTIO3 SUBSTRATES. WHEN OPERATED IN THE QUANTUM MODE, OUR PROPOSED HTC BASED SIS DETECTOR CAN POTENTIALLY HAVE A VERY HIGH SENSITIVITY FOR LWIR DETECTION. WE PLAN TO USE A UNIQUE MOCVD BASED ATOMIC LAYER EPITAXY APPROACH. OUR SELECTION OF ATOMIC LAYER MOCVD ELIMINATES THE ABRUPTNESS AND THICKNESS CONTROL PROBLEMS THAT PLAGUE CONVENTIONAL MATERIAL DEPOSITION TECHNIQUES. THIS DEMONSTRATED TECHNIQUE (BY US AND SEVERAL OTHER RESEARCH GROUPS) RESULTS IN ATOMICALLY CONTROLLED INTERFACES AND SURFACES. THE PHASE I PROGRAM WILL RESULT IN HIGH QUALITY SINGLE CRYSTAL LAYERS OF SUPERCONDUCTING YBACUO. WE WILL THEN DEMONSTRATE ABRUPT INSULATOR SUPERCONDUCTOR INTERFACES. WE EXPECT TO BE ABLE TO CONTROL THIS TO WITHIN AN ATOMIC SCALE DUE TO THE USE OF THE ALE APPROACH. METAL INSULATOR SUPERCONDUCTOR(MIS) DEVICES WILL THEN BE FABRICATED AND CHARACTERIZED TO BE USED AS LWIR SENSORS. THE PHASE II PROGRAM WILL FOCUS ON DEPOSITING THE ENTIRE SIS JUNCTION AND FABRICATING LWIR SENSORS. WE PLAN TO COLLABORATE WITH PROFESSOR SINGH OF OKLAHOMA UNIVERSITY ON THE PROPOSED EFFORT. HE WILL ACT AS A CONSULTANT TO THE PROGRAM. DR. SINGH'S EXPERTISE WITH ATOMIC LAYER EPITAXY AND SEMICONDUCTING DEVICES GIVES A HIGH SUCCESS PROBABILITY TO THE PROPOSED EFFORT. APA OPTICS AT PRESENT HAS A SID SUPPORTED PROGRAM AIMED AT DEVELOPING HTC MATERIALS FOR SENSOR APPLICATIONS. THIS ONGOING PROGRAM WILL BE HIGHLY BENEFICIAL AS IT WILL PROVIDE SEVERAL RELATED TECHNOLOGIES AT NO COST TO THE PROGRAM. ANTICIPATED BENEFITS - LWIR SENSING IS THE BASIS FOR SEVERAL DOD AND COMMERCIAL APPLICATIONS.

APPLIED SCIENCE AND TECHNOLOGY, INC.
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Topic#: 91-097
Office: DSO
Contract #: DAAH0192CR137
PI: EVELIO SEVILLANO

ID#: 9120607

Title: HALOGEN ASSISTED DIAMOND DEPOSITION IN A MICROWAVE PLASMA REACTOR

Abstract: MICROWAVE PLASMA ENHANCED CHEMICAL VAPOR DEPOSITION (PECVD) OF DIAMOND FILMS USING HALOGEN BASED CHEMISTRIES IS PROPOSED IN ORDER TO DEVELOP A LOW TEMPERATURE DIAMOND DEPOSITION PROCESS. THE UNIQUE PROPERTIES OF DIAMOND, AN INSULATOR WITH THE HIGHEST ROOM TEMPERATURE THERMAL CONDUCTIVITY, MAKE IT AN ATTRACTIVE MATERIAL TO BE USED FOR IMPROVING THE THERMAL DISSIPATION PROPERTIES OF HIGH POWER DENSITY MICROELECTRONIC DEVICES. RECENT REPORTS INDICATE THAT HALOGEN BASED CHEMISTRIES HAVE ALLOWED A SIGNIFICANT REDUCTION OF THE DEPOSITION TEMPERATURE REQUIRED FOR DIAMOND DEPOSITION IN THERMAL CVD REACTORS. SUCH A REDUCTION IN TEMPERATURE WOULD ALLOW THE DEPOSITION OF THE

DIAMOND FILMS DIRECTLY OVER HIGH POWER MICROELECTRONICS CHIPS. IN THIS WORK, WE PROPOSE THE USE OF MICROWAVE PECVD SINCE IT HAS CONSISTENTLY GENERATED (IN HYDROGEN-METHANE CHEMISTRIES) DIAMOND FILMS OF THE HIGHEST QUALITY WITH THERMAL CONDUCTIVITIES WHICH APPROACH THAT OF NATURAL DIAMOND. OPERATION OF THE CHIP AFTER DIAMOND DEPOSITION WOULD PROVIDE A PROOF-OF-PRINCIPLE EXPERIMENT FOR THE FEASIBILITY OF THE PROPOSED APPROACH. HIGH THERMAL CONDUCTIVITY DIAMOND FILMS DEPOSITED AT LOW TEMPERATURES WOULD GREATLY ENHANCE THE KIND OF MATERIALS OVER WHICH THESE FILMS CAN BE DEPOSITED (MOSTLY CERAMICS AND REFRACTORY METALS). A SIGNIFICANT REDUCTION ON THE DEPOSITION TEMPERATURE WOULD ALLOW DEPOSITION ON E.G. ALUMINUM AND IN PRINCIPLE OVER PLASTICS. DIAMOND FILMS DIRECTLY DEPOSITED ON COMPLETED MICROELECTRONIC DEVICES COULD HAVE A SIGNIFICANT IMPACT ON THE LEVELS OF DEVICE INTEGRATION THAT CAN BE ATTAINED IN SI OR GAAS BASED DEVICES.

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Topic#: 91-071 ID#: 9110728
Office:
Contract #: DAAH0191CR156
PI: JYH-MING TING
Title: MOLYBDENUM DISILICIDE MATRIX COMPOSITES BY SLIP CASTING
Abstract: ALTHOUGH MOLYBDENUM DISILICIDE (MOSI2) EXHIBITS HIGH-TEMPERATURE CHEMICAL STABILITY AND HAS A MELTING POINT OF 2010 DEGREES CENTIGRADE, THE LACK OF ROOM-TEMPERATURE FRACTURE TOUGHNESS AND POOR HIGH-TEMPERATURE CREEP RESISTANCE HAVE SEVERELY LIMITED ITS STRUCTURAL APPLICATIONS. THEREFORE, IT IS DESIRED TO FABRICATE COMPOSITES USING MOSI2, AS THE MATRIX MATERIAL. UNLIKE THE CONVENTIONAL CVI PROCESS, WE PROPOSE A NOVEL SLIP CASTING TECHNIQUE TO FABRICATE SUCH COMPOSITES. THIS TECHNIQUE IS A MODERATE-TEMPERATURE, NET-SHAPE PROCESS WITH THE ADVANTAGES OF SHORTER PROCESSING TIME AS COMPARED TO CVI, LOW COST DUE TO THE REDUCTION IN PROCESSING TIME AND PROCESSING TEMPERATURE, ETC. ANTICIPATED BENEFITS - IT IS ANTICIPATED THAT THE PROPOSED SLIP CASTING PROCESS WILL PROVIDE AN ECONOMICAL PATH IN FABRICATING MOSI2 MATRIX COMPOSITES. THE NET-SHAPE FORMING CAPABILITY OF THIS PROCESS ELIMINATES THE PROBLEMS OF JOINING DIFFERENT MATERIALS. THE POTENTIAL APPLICATIONS INCLUDE WHERE MATERIALS ARE REQUIRED TO EXHIBIT EXCELLENT OXIDATION RESISTANCE AND HIGH MECHANICAL STRENGTH.

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Topic#: 91-017 ID#: 9110217
Office:
Contract #: DAAH0191CR166
PI: LEONARD SCHWER
Title: COUPLING IN JOINTED MEDIA
Abstract: THE PROPOSED RESEARCH WILL PROVIDE A FOCUSED SET OF LABORATORY EXPERIMENTS WHICH WILL HELP TO QUANTIFY SOME OF THE CRITICAL EFFECTS OF JOINTED ROCK MEDIA ON COUPLING OF NUCLEAR EXPLOSIONS. THE SELECTION OF A FOCUSED SET OF LABORATORY EXPERIMENTS WILL BE GUIDED BY THE AVAILABLE KNOWLEDGE FROM THE COUPLING COMMUNITY AND A NUMERICAL (FINITE ELEMENT) PARAMETER STUDY SPANNING THE JOINTED MEDIA COUPLING CRITICAL PARAMETERS. IN OUR PROPOSED EFFORT, WE WILL DEMONSTRATE EXPERIMENTAL AND COMPUTATIONAL TECHNIQUES FOR MODELING AND PREDICTING COUPLING EFFECTS IN JOINTED MEDIA. THE CLOSE INTERACTION OF EXPERIMENTS AND NUMERICAL SIMULATIONS IS THE KEY TO A SUCCESSFUL EFFORT: THE EXPERIMENTS PROVIDE BENCHMARKS TO BE USED IN ASSESSING THE FIDELITY OF THE NUMERICAL SIMULATIONS, AND THE NUMERICAL SIMULATIONS PROVIDE AN ECONOMICAL METHOD OF VARYING CRITICAL PARAMETERS BETWEEN AND BEYOND THOSE USED IN THE EXPERIMENTS. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE NEED FOR THE CAPABILITIES DEVELOPED UNDER THIS SBIR PROPOSAL IS ILLUSTRATED BY THE JOINT VERIFICATION EXPERIMENT (JVE). THE JVE IS CURRENTLY UNDERWAY TO CALIBRATE THE NUCLEAR TEST SITES IN THE USSR, I.E., SEMIPALATINSK AND NOVYA ZEMLYA. THE CURRENT CALIBRATION PROCESS IS INADEQUATE AT WEAPON YIELDS BELOW ABOUT 10 KT OF TNT

EQUIVALENCE. THIS INADEQUACY RENDERS NUCLEAR MONITORING INEFFECTIVE FOR COMPLIANCE WITH A LIMITED TEST BAN TREATY THAT USES 10 KT AS A CEILING ON YIELDS.

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Topic#: 91-131 ID#: 9121143
Office: LSO
Contract #: DAAH0192CR015
PI: OLIN MCDANIEL
Title: HIGH PAYOFF MINE/BARRIER CONCEPTS
Abstract: A NOVEL HIGH VOLTAGE DELAY CIRCUIT IS PROPOSED FOR USE WITH EXPLODING FOIL INITIATORS. THIS ALLOWS THE MANUFACTURE OF AN INEXPENSIVE MULTIMODE WARHEAD USEFUL AGAINST TANKS, APCS, AND SOFT TARGETS. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - A COMMON WARHEAD MAY BE DERIVED THAT CAN BE USED IN BOTH SMART SUBMUNITIONS AND LANDMINES, SAVING THE GOVERNMENT DEVELOPMENT AND MANUFACTURING COSTS.

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Phone: (904) 371-2567
Topic#: 91-183 ID#: 9120854
Office: CSTO
Contract #: DAAH0192CR144
PI: GLENN ZELNIKER
Title: PENPAD-BASED COMPUTER-AIDED INSTRUCTION
Abstract: THERE IS MOUNTING EVIDENCE THAT OUR SECONDARY MATHEMATICS AND SCIENCE EDUCATIONAL DELIVERY SYSTEM IS IN A STATE OF CRISIS. THE PROBLEMS ARE PROFOUND AND SEEMINGLY ENDLESS. WHILE IT IS AXIOMATIC THAT OUR EDUCATIONAL INFRASTRUCTURE NEEDS TO BE REBUILT, IT IS ALSO SELF-EVIDENT THAT THE ISSUES OF COST, CURRICULUM INSERTION, AND TEACHER ACCEPTANCE MUST BE SIMULTANEOUSLY ADDRESSED. THE LEADING CANDIDATE, IN OUR OPINION, IS LEVERAGING OUR EXPERIENCE IN THE FIELD OF COMPUTER AIDED INSTRUCTION, OR CAI. THE ATHENA GROUP OFFERS PENGUIN AS A MAJOR ALTERNATIVE TO THE EXISTING STATE OF AFFAIRS. PENGUIN EXPLOITS A RADICALLY NEW TECHNOLOGY, REFERRED TO AS A "NOTEPAD" (A.K.A., TABLET, STYLUS, PEN-BASED, PEN PC, OR ELECTRONIC SLATE) COMPUTER. PENGUIN CAN FUNCTION AS A COMPLETELY PORTABLE AND TOTAL CAI ENVIRONMENT REPLETE WITH COURSEWARE AND DOCUMENT PROCESSING. PENGUIN HAS A HIGH GRAPHICAL CONTENT, BOTH IN TERMS OF COMPUTER GENERATED GRAPHICS AND USER (HAND) DRAWN GRAPHICS! THE RESEARCH PROGRAM INVOLVES ACTIVITIES IN TOOL BUILDING (DEVELOPING THE BASIC PENGUIN TECHNOLOGY), DEVELOPING NEW AND INNOVATIVE GRAPHICS CAPABILITIES, PREPARING AND TESTING COURSEWARE, AND INTEGRATING THESE ELEMENTS INTO ONE CONSISTENT ENVIRONMENT. IN ADDITION, THE PEDAGOGICAL POTENTIAL WILL BE EVALUATED BY EDUCATORS UNDER CLASSROOM CONDITIONS. PENGUIN OFFERS A MAJOR ALTERNATIVE TO THE EXISTING CAI STATE OF AFFAIRS, BY PROVIDING THE SCIENCE EDUCATIONAL COMMUNITY WITH FEATURES AND CAPABILITIES NOT FOUND IN ANY OTHER TECHNOLOGY. PENGUIN OFFERS THE ACADEMIC COMMUNITY A HIGH QUALITY, HIGH VALUE, COMPLETELY PORTABLE, AND ROBUST TECHNOLOGY WHICH CAN BOTH SUPPORT LABORATORY ACTIVITIES AND BE AN INTEGRATING AGENT OF ENGINEERING CURRICULA. PENGUIN HAS THE POTENTIAL TO BECOME THE FIRST TRULY PERSONAL ELECTRONIC EDUCATIONAL EXPERIENCE.

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Topic#: 91-018 ID#: 9110502
Office:
Contract #: DAAH0191CR319
PI: VICTOR TOM
Title: AUTOMATIC DETECTION OF MINERAL DEVELOPMENT SITES FROM MULTISPECTRAL IMAGERY
Abstract: THIS PROPOSAL SEEKS TO ESTABLISH THE FEASIBILITY OF APPLYING NEWLY DEVELOPED MORPHOLOGY-BASED IMAGE SCREENING AND DETECTION ALGORITHMS TO THE MINERAL DEVELOPMENT SITE DETECTION PROBLEM IN PANCHROMATIC AND MULTISPECTRAL IMAGERY AND TO DESIGN AN

OVERALL PROCEDURE FOR INTEGRATING THIS TECHNOLOGY INTO AN EFFECTIVE, PRACTICAL AND USER FRIENDLY IMAGE ANALYST TOOL. OUR UNIQUE MORPHOLOGICAL APPROACH ENABLES US TO EXPLOIT SHAPE, SIZE, SPATIAL STRUCTURE, TEXTURE AND SPECTRAL SHAPE TO RAPIDLY DETECT PROBABLE INSTANCES OF MINERAL DEVELOPMENT SITES IN OVERHEAD IMAGERY. THE COMPUTATIONAL ADVANTAGES OF THIS APPROACH MAKE IT IDEALLY SUITED FOR HIGH-SPEED PROCESSING OF LARGE VOLUMES OF IMAGERY USING SPECIALIZED HARDWARE OR FINE-GRAINED PARALLEL COMPUTERS SUCH AS THE CONNECTION MACHINE. THIS NOVEL IMAGE SCREENING APPROACH WILL REDUCE THE AMOUNT OF IMAGERY THAT NEEDS TO BE VIEWED AND EXPLOITED BY IMAGE ANALYSTS, PERMITTING THE ANALYSTS TO PERFORM WHAT THEY DO BEST, IMAGE INTERPRETATION RATHER THAN WIDE AREA SEARCH. OUR PHASE I PROPOSAL IS TO ESTABLISH FEASIBILITY OF OUR APPROACH FOR THE MINERAL DEVELOPMENT SITE DETECTION PROBLEM. EFFICIENT ALGORITHM IMPLEMENTATIONS ON A PARALLEL COMPUTER WILL OCCUR IN A PHASE II PROTOTYPING EFFORT. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE PHASE I RESEARCH WILL DEMONSTRATE THE FEASIBILITY AND POTENTIAL OF THE MORPHOLOGICAL PROCESSING APPROACH AND LAY THE GROUNDWORK FOR FURTHER ALGORITHM VALIDATION AND PROTOTYPE DEVELOPMENT OF AN IMAGE ANALYST TOOL IN A PHASE II PROGRAM. THIS TECHNOLOGY IS APPLICABLE TO A NUMBER OF LABOR INTENSIVE TASKS IN IMAGE EXPLOITATION WHERE WIDE AREA SEARCH IS INVOLVED.

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Topic#: 91-106 ID#: 9120987
Office: DSO
Contract #: DAAH0192CR131
PI: RICHARD ORR

Title: GABOR/WIGNER-VILLE PROCESSING FOR CROSSTERM SUPPRESSION, RESOLUTION ENHANCEMENT AND NOISE REDUCTION IN UNDERWATER...

Abstract: THE WIGNER-VILLE (WV) DISTRIBUTION FINDS FAVOR IN PROCESSING FOR ACOUSTIC TRANSIENT SIGNATURE IDENTIFICATION BECAUSE OF ITS ABILITY TO PORTRAY TIME HISTORY OF THE FREQUENCY DISTRIBUTION OF SIGNAL ENERGY. A KEY ISSUE OF CURRENT RESEARCH ON THE WV DISTRIBUTION IS THE SUPPRESSION OF QUADRATICALLY-INDUCED CROSSTERMS IN THE REPRESENTATION OF SUPER-POSED SIGNALS. WE PROPOSE TO RESEARCH METHODS FOR CROSSTERM SUPPRESSION, RESOLUTION ENHANCEMENT AND NOISE REDUCTION BASED ON INTRODUCTION OF A SIGNAL'S GABOR EXPANSION INTO THE WV DISTRIBUTION. CROSSTERM CONTROL IS EXERCISED BY SIMULTANEOUS MINIMIZATION OF THE NUMBER OF SIGNIFICANT TERMS IN THE EXPANSION AND ELIMINATION OF THE GABOR BASIS CROSSTERMS IN A "CROSSTERM-DELETED" REPRESENTATION. APPROPRIATE CHOICE OF A GABOR WINDOW FUNCTION–ONE WELL MATCHED TO THE DATA CHARACTERISTICS–IN THIS REPRESENTATION WILL BOTH REDUCE THE NUMBER OF CROSSTERMS AND DECREASE OVERLAP (INCREASE RESOLUTION) AMONG THE AUTOTERMS. NONLINEAR PREPROCESSING OF THE GABOR COEFFICIENTS UNDER MATCHED WINDOW CONDITIONS CAN SUBSTANTIALLY ATTENUATE NOISE PRIOR TO COMPUTATION OF THE WV DISTRIBUTION. THE PROPOSED PROGRAM WILL YIELD A TESTBED OF NOVEL METHODS UPON WHICH ADVANCED RESEARCH IN SIGNATURE IDENTIFICATION CAN BE BASED. THE PROPOSED PROJECT HAS POTENTIAL APPLICATION TO CURRENTLY ACTIVE AREAS OF GOVERNMENT RESEARCH, E.G., DEVELOPING AN AUTOMATED SIGNAL PROCESSING FACILITY TO AID IN CLASSIFICATION OF ACOUSTIC EVENTS AT SEA. THE SIGNAL REPRESENTATIONS MADE AVAILABLE BY THE PROPOSED EFFORT WOULD PROVIDE ADDITIONAL TOOLS THAT COULD BE IMPLEMENTED IN FIRMWARE/ HARDWARE AND TRANSFERRED TO A FACILITY SUCH AS THAT SUPPORTED BY DARPA AT ORINCON CORP.

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Topic#: 91-232 ID#: 9120652
Office: UWO
Contract #: DAAH0192CR133
PI: DR. KIRK BEZJIAN

Title: NOVEL MICROCHANNEL PLATES FOR CHARGE-COUPLED DEVICE INTENSIFICATION

Abstract: WE PROPOSE TO DEVELOP A TUBE INTENSIFIER THAT HAS A RESOLUTION APPROPRIATE TO

1024X1024 AND 2048X2048 PIXEL CHARGE COUPLED DETECTORS. THIS INTENSIFIER WILL BE MADE POSSIBLE BY THE DEVELOPMENT OF A NOVEL-DESIGN MICROCHANNEL PLATE. THE MICROCHANNELS ARE TO BE DELINEATED WITH MICROLITHOGRAPHIC PATTERNING OF AN INSULATING SUBSTRATE. THE MICROCHANNELS ARE THEN MICROFABRICATED BY THE USE OF ANISOTROPIC ETCHING. SUCH MICROCHANNEL PLATES WILL HAVE THEIR CHANNELS SPACED REGULARLY. THEY CAN BE STACKED IN Z OR CHEVRON CONFIGURATIONS WITHOUT ANY LOSS OF IMAGE RESOLUTION. THE SAME TECHNOLOGY WILL BE APPLICABLE TO THE MANUFACTURE OF MICROCHANNEL ARRAYS WITH OPTIMAL CHANNEL SIZES AND ASPECT RATIOS. THESE MICROCHANNEL ARRAYS CAN BE EMPLOYED AS RESOLUTION-CONSERVING OUTPUT BUFFERS BETWEEN THE LAST MICROCHANNEL AND THE PHOSPHOR. THE RESEARCH WILL DETERMINE THE POSSIBLE MINIMUM FEATURE SIZE AND ASPECT RATIOS OF OTHER MICROCHANNELS. THE REST OF THE RESEARCH EFFORT WILL CONCENTRATE ON ESTIMATING THE SPATIAL RESOLUTION OF AN IMAGE INTENSIFIER TUBE MANUFACTURED WITH THE NOVEL MICROCHANNEL PLATES. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATION - HIGH-RESOLUTION IMAGE INTENSIFIERS FOR ASTRONOMY, REMOTE SATELLITE SENSING, AND ROBOTIC DETECTION.

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Topic#: 91-119
Office: DSO
Contract #: DAAH0192CR154
PI: ADRIAN SMITH, JR.

ID#: 9120539

Title: FUNDAMENTAL STUDIES IN HIGH-ENERGY ELECTRON-BEAM WELDING

Abstract: WELDING USING HIGH-ENERGY (10-20MEV) ELECTRON BEAMS OFFERS POTENTIAL ADVANTAGES OVER CONVENTIONAL ELECTRON-BEAM WELDING TECHNOLOGIES. POTENTIAL ADVANTAGES OF HIGH-ENERGY ELECTRON BEAM WELDING INCLUDE THE CAPABILITY OF MAKING VERY HIGH QUALITY WELDS IN VERY THICK AND/OR LARGE WORKPIECES AT OR ABOVE ATMOSPHERIC PRESSURES. THE USE OF A HIGH-ENERGY ELECTRON BEAM OBVIATES THE NEED FOR THE NEAR-VACUUM ENVIRONMENT REQUIRED BY CONVENTIONAL ELECTRON-BEAM *WELDING.* THICKER WORKPIECES CAN BE ACCOMMODATED BECAUSE OF THE DEEPER PENETRATION INTO THE WORKPIECE OF HIGHER-ENERGY BEAMS. THE OBJECTIVE OF THIS PROPOSED EFFORT IS TO FURTHER EXPLORE THE POTENTIAL OF HIGH-ENERGY ELECTRON BEAM WELDING BY (1) ANALYZING THE INTERACTION BETWEEN THE HIGH-ENERGY ELECTRON BEAM AND METALS AND (2) DEVELOPING A PRELIMINARY DESIGN FOR A REAL-TIME PROCESS MONITOR BASED ON THE USE OF THE X-RAYS EMITTED BY THE BEAM TO "ILLUMINATE" THE WELD PROGRESS. THE END PRODUCTS OF THIS EFFORT WILL BE (1) AN IMPROVED UNDERSTANDING OF THE RELEVANT INTERACTION PHYSICS; AND (2) THE BASIS FOR THE ENGINEERING DESIGN AND CONSTRUCTION OF PROTOTYPE MONITOR HARDWARE. THESE END PRODUCTS WILL CONSTITUTE THE FOUNDATIONS BOTH FOR A PHASE II SBIR EFFORT AND FOR EXPLORATORY DEVELOPMENT OF A PROTOTYPICAL HEEBW SYSTEM. HIGH ENERGY ELECTRON BEAM WELDING HAS THE POTENTIAL TO FACILITATE MAKING WELDS OF VERY HIGH QUALITY IN VERY LARGE AND/OR THICK WORKPIECES. THE X-RAYS EMITTED BY THE BEAM IN INTERACTING WITH THE WORKPIECE CAN BE USED TO MONITOR THE PROGRESS OF THE WELD IN REAL TIME. THESE FEATURES WILL PROVIDE ENHANCED WELDING CAPABILITIES IN MANY GOVERNMENT AND COMMERCIAL APPLICATIONS; SHIPBUILDING IS AN EXCELLENT EXAMPLE.

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Topic#: 91-115
Office: DSO
Contract #: DAAH0192CR082
PI: THOMAS BARR, JR.

ID#: 9120144

Title: EFFICIENT SLAB LASERS

Abstract: THE OFFERORS PROPOSE TO EFFECTIVELY INTEGRATE THE USSR TECHNOLOGY FOR MULTIPASS AMPLIFIERS WITH USA TECHNOLOGY FOR HIGH AVERAGE ENERGY LOADING AND STRONG COOLING, TO PRODUCE ADVANCED EFFICIENT SLAB LASER DESIGNS FOR 1 KILOWATT OUTPUT DOWER OPERATION IN BOTH HIGH REP RATE Q-SWITCHED AND CW MODES. SLAB LASER DESIGNS HAVE INTRINSIC ADVANTAGE

OVER ROD LASER DESIGNS AND CAN BE SCALED FOR HIGH POWER OUTPUTS WITH GOOD BEAM QUALITY. HOWEVER, AMPLIFIED STIMULATED EMISSIONS (ASE) AND PARASITIC OSCILLATIONS (PO) LIMIT EFFICIENT ENERGY EXTRACTION. WE INTRODUCE THE MULTIPASS PROCESS, AS DEVELOPED BY THE SOVIETS, TO STRIP ALL AVAILABLE GAIN FROM THE SYSTEM - THE NET EFFECT BEING AN EFFICIENT SLAB LASER WHICH HAS NEAR-DIFFRACTION-LIMIT OUTPUT AND A RESIDUAL GAIN OF UNITY. THUS, THERE IS NO GAIN TO FEED THE UNDESIRABLE ASE AND PO CHANNELS. BOTH 1 KILOWATT DESIGNS, PREPARED UNDER PHASE I EFFORT, WILL INCLUDE PRELIMINARY TIME AND COST ANALYSIS FOR FACILITATING PHASE II CONSTRUCTION AND DEMONSTRATION. OUR INTENT IS TO HAVE A MARKETABLE PRODUCT READY FOR COMMERCIAL DEVELOPMENT, AT OUTPUT POWERS BETWEEN 500 WATTS AND 5 KILOWATTS, DURING PHASE III. OUR PRIMARY COMMERCIAL OBJECTIVE IS TO SIGNIFICANTLY PENETRATE THE WORLD-WIDE INDUSTRIAL CUSTOMER BASE OF 20,000 WORKSTATIONS INVOLVED IN THE LASER PROCESSING OF BOTH ADVANCED AND STANDARD MATERIALS (METALS, COMPOSITES, ETC.). COMMERCIAL APPLICATIONS, MANY PAIRED WITH FIBER OPTIC BEAM DELIVERY, INVOLVE BOTH THE ADVANCED PROCESSING OF BOTH STANDARD AND ADVANCED MATERIALS AS WELL AS THE DELIVERY OF ENERGY AND INFORMATION AND THE PUMPING OF OTHER LASER DEVICES. OUR PRIMARY COMMERCIAL OBJECTIVE IS TO SIGNIFICANTLY PENETRATE THE WORLD-WIDE INDUSTRIAL CUSTOMER BASE OF 20,000 WORKSTATIONS INVOLVED IN THE LASER PROCESSING OF MATERIALS (METALS, COMPOSITES, ETC.).

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Topic#: 91-071 ID#: 9110721
Office:
Contract #: DAAH0191CR181
PI: GEORGE HIDA

Title: REACTION-SINTERING OF MOLYBDENUM DISILICIDE (MOSI2) MATRIX COMPOSITES

Abstract: REINFORCEMENT OF A MOLYBDENUM DISILICIDE MATRIX IS NECESSARY FOR ITS STRUCTURAL APPLICATIONS. CONVENTIONAL METHODS OF PRODUCING MOSI2 COMPOSITES ARE LABOR AND ENERGY INTENSIVE, AND HAVE THE PROBLEM OF PRESERVING THE STRUCTURAL INTEGRITY OF THE REINFORCEMENT. BENCHMARK'S INNOVATIVE METHOD CONSISTS OF SIMULTANEOUS MOSI2 POWDER SYNTHESIS AND COMPOSITE CONSOLIDATION THROUGH REACTION-SINTERING BY ITS CONTROLLED COMBUSTION-SYNTHESIS TECHNIQUE. PROPERLY CHOSEN RAW MATERIALS, COMBINED WITH SUITABLE TREATMENT OF THE REACTANT MIXTURE, AND FOLLOWED BY ADEQUATE MIXING-DISPERSION OF THE REINFORCEMENT, ALLOWS FOR FABRICATION OF MOSI2 COMPOSITES. THE SPEED OF THE POWDER SYNTHESIS TOGETHER WITH THE REACTION-SINTERING FEATURE OF THE PROCESS CAN PROVIDE A FULLY CONSOLIDATED BODY WITH NO REINFORCEMENT DAMAGE. THE PROPAGATION MODE OF THE COMBUSTION FRONT AND THE POST-COMBUSTION STAGE FEATURES PERMIT FULL CONTROL OF THE MATRIX PARTICLE SIZE DISTRIBUTION, ITS STRUCTURE, AND THE WHOLE COMPOSITE CONSOLIDATION. THE PROCESS IS SIMPLE,INEXPENSIVE, AND CAN BE EASILY SCALED UP, MAKING IT COMMERCIALLY ATTRACTIVE. BENCHMARK'S DEVELOPMENT OF THE CONTROLLED COMBUSTION-SYNTHESIS TECHNIQUE MAKES POSSIBLE THE FABRICATION OF ADVANCED CERAMIC MATERIALS, SINGLE PHASES AND COMPOSITES, WITH A PRE-DETERMINED COMPOSITION AND STRUCTURE. TECHNICAL ASSISTANCE AND TESTING WILL BE PROVIDED BY TEXTRON SPECIALTY MATERIALS, A SUBSIDIARY OF TEXTRON, INC. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - HIGH PERFORMANCE MOLYBDENUM DISILICIDE COMPOSITES PRODUCED FROM INEXPENSIVE RAW MATERIALS BY CONTROLLED COMBUSTION-SYNTHESIS TECHNIQUE ARE CHARACTERIZED BY LOW ENERGY CONSUMPTION AND SHORT-RUN PROCESSES, AND ARE EXPECTED TO FIND FAST GROWING INDUSTRIAL APPLICATIONS IN HIGH TEMPERATURE, CORROSIVE ENVIRONMENTS.

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Topic#: 91-110 ID#: 9121205
Office: DSO
Contract #: DAAH0192CR083
PI: R. DEAN HARRIS

Title: BIONETIC DESIGNS FOR FREE ENERGY TRANSDUCTION USING BIOELASTIC MATERIALS

Abstract: LIVING ORGANISM THRIVE BY HAVING EVOLVED (1) MECHANISMS OF HIGH EFFICIENCY FOR THE INTERCONVERSION OF ENERGY AND (2) MATERIALS CAPABLE OF EXTRAORDINARY DURABILITY, E.G. THE ELASTIC FIBER OF THE AORTIC ARCH BEING CAPABLE OF SUSTAINING BILLIONS OF STRETCH/RELAXATION CYCLES. THESE PROPERTIES OF HIGH EFFICIENCY AND POTENTIAL DURABILITY ARE COMBINED IN SYNTHETIC ELASTIC PROTEIN-BASED POLYMERS. THIS PROJECT IS BASED ON A NEW, EFFICIENT MECHANISM OF FREE ENERGY TRANSDUCTION IN WHICH A FOLDING/UNFOLDING TRANSITION IN ELASTIC PROTEIN-BASED POLYMERS CAN BE CONTROLLED BY ANY OF THE INTENSIVE VARIABLES OF TEMPERATURE, PRESSURE, MECHANICAL FORCE, CHEMICAL POTENTIAL AND ELECTRICAL POTENTIAL. THE TECHNICAL OBJECTIVES ARE (1) TO DEMONSTRATE BAROMECHANICAL, BAROCHEMICAL AND BAROELECTRICAL TRANSDUCTION IN SYNTHETIC ELASTIC PROTEIN-BASED POLYMERS, I. BY SYNTHESIS OF APPROPRIATE PROTEIN-BASED POLYMERS, II. BY IDENTIFYING AND COUPLING APPROPRIATE REDOX COUPLES, III. BY CONSTRUCTION OF A TRANSPARENT PRESSURIZABLE CELL, AND IV. BY EQUIPPING THE PRESSURIZABLE CELL FOR POTENTIOMETRIC TITRATIONS, (2) TO MONITOR VISUALLY BAROMECHANICAL TRANSDUCTION IN THE TRANSPARENT PRESSURIZABLE CELL, AND (3) TO MONITOR PH CHANGES AND REDUCTION POTENTIAL CHANGES RESULTING FROM THE APPLICATION OF PRESSURE. THE FOUR DIFFERENT ELASTIC PROTEIN-BASED POLYMERS, UTILIZING AS ITS PRIMARY COMPONENT THE ELASTOMERIC POLYPEPTIDE, POLY(VAL-PRO-GLY-VAL-GLY), ARE TO BE PREPARED BY SOLUTION PEPTIDE CHEMISTRY GIVING RISE TO HIGH MOLECULAR WEIGHT POLYMERS WHICH ARE TO BE Y-IRRADIATION CROSS-LINKED TO FORM ELASTOMERIC MATRICES AND STUDIED FOR THE ABOVE-NOTED TRANSDUCTIONAL PROPERTIES. A UNIFYING FREE ENERGY TRANSDUCTION MECHANISM, IN WHICH THE CENTRAL TRANSDUCTIONAL PROCESS IS REVERSIBLE HYDROPHOBIC FOLDING AND UNFOLDING IN AN AQUEOUS MILIEU OF DOMINANTLY ENTROPIC ELASTOMERS DERIVED FROM THE BIOLOGICAL ELASTIC FIBER, HAS BEEN DEMONSTRATED TO HAVE REMARKABLE REVERSIBILITY FOR THERMOMECHANICAL TRANSDUCTION AND DESIGNED TO BE CAPABLE OF CHEMOMECHANICAL TRANSDUCTION OF HIGH EFFICIENCY.

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Topic#: 91-102 ID#: 9120113
Office: DSO
Contract #: DAAH0192CR089
PI: BRIAN DIXON
Title: SUPERELECTROCHEMICAL DESTRUCTION OF CBW AGENTS
Abstract: AN ELECTROCHEMICAL PROCESS IS DESCRIBED WHICH IS CAPABLE OF DEMILITARIZING A WIDE RANGE OF CBW AGENTS. SINCE THE UNIQUE PROCESS CAN SIMULTANEOUSLY FUNCTION BY THREE DIFFERENT CHEMICAL MECHANISMS, ITS VERSATILITY FOR DEGRADING A NUMBER OF CHEMICALLY DISTINCT CBW AGENT TYPES IS ASSURED. IN ADDITION, PREVIOUS RESEARCH HAS ESTABLISHED THE CAPABILITY OF THE SYSTEM FOR COMPLETELY DEGRADING ORGANIC CONTAMINANTS TO SUCH HARMLESS PRODUCTS AS CHLORIDE ION, CARBON DIOXIDE AND WATER. THE INNOVATIVE TECHNOLOGY DESCRIBED WILL HAVE WIDE APPLICATION FOR THE COMPLETE DEGRADATION OF A VARIETY OF HAZARDOUS SUBSTANCES. AS SUCH, THERE WILL BE MANY LARGE POTENTIAL COMMERCIAL APPLICATIONS AFTER DEVELOPMENT THROUGH PHASES II AND III.

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Topic#: 91-020 ID#: 9110495
Office:
Contract #: DAAH0191CR183
PI: H. SMITH
Title: APPLICATION OF GIGAHERTZ WAFER PROBE TECHNOLOGY TO MULTICHIP MODULE PRODUCTION
Abstract: ADAPTATION OF STATE-OF-THE-ART GIGAHERTZ WAFER PROBE TECHNOLOGY (WPT) FOR USE IN DESIGN, TROUBLESHOOTING, AND PRODUCTION OF MULTICHIP MODULES (MCMS) IS PROPOSED. THESE PROBES ARE CURRENTLY CAPABLE OF TESTING SEMICONDUCTOR DEVICES ON WAFERS AT FREQUENCIES UP TO 75 GHZ. PHASE I WILL SHOW THE ELECTRICAL AND MECHANICAL FEASIBILITY OF PROBING MCMS AND SET DIRECTION FOR PHASE II. KEY TASKS INCLUDE ESTABLISHING TEST POINT DESIGN RULES, MECHANICAL FIXTURING, AND HIGH IMPEDANCE PROBES FOR REDUCED LOADING OF ACTIVE CIRCUITS.

PHASE II WILL DEVELOP PRODUCTION READY MCM PROBES AND DEMONSTRATE THEIR USE ON A POPULATED MODULE. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE PROPOSED DEVELOPMENT WOULD ALLOW ACCURATE REPEATABLE MEASUREMENTS DURING DESIGN, EVALUATION, FAILURE ANALYSIS, AND PRODUCTION OF MCMS. THIS WILL PROVIDE THE NECESSARY DATA FOR DEVELOPING ACCURATE CIRCUIT AND RELIABILITY MODELS. IT WILL ALSO ALLOW COST EFFECTIVE PRODUCTION OF MCMS BY CORRECTLY IDENTIFYING FAILED COMPONENTS DURING PRODUCTION AND BURN IN.

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Topic#: 91-004 ID#: 9110255
Office:
Contract #: DAAH0191CR182
PI: SUMAN GANGULY
Title: MAGNETIC ARRAY
Abstract: SENSITIVITIES IN MAGNETIC AND LOW-FREQUENCY ELECTROMAGNETIC BANDS HAVE BEEN LIMITED BY AMBIENT NOISE. SENSORS ARE AVAILABLE WITH EXTREMELY LOW NOISE LEVELS (ABOUT FIVE ORDERS OF MAGNITUDE LOWER THAN THE AMBIENT NOISE). WE PROPOSE TO USE SUCH SENSORS IN AN ARRAY CONFIGURATION WHERE IT IS POSSIBLE TO OBTAIN SENSITIVITIES APPROACHING THOSE OF THE SENSORS THEMSELVES. ALGORITHMS FOR SUCH NOISE CANCELLATION HAVE BEEN DEVELOPED, AND DURING PHASE I WE PROPOSE TO DEMONSTRATE THE FEASIBILITY OF THE NOISE CANCELLATION SCHEME IN AN EXPERIMENTAL FIELD. REMOVAL OF THE LARGE NOISE FIELD WILL ALLOW LARGE INCREASE IN SENSITIVITY AND CONSEQUENT INCREASE DETECTION RANGE FOR VARIOUS TARGETS. THE SCHEME ALSO ALLOWS TRACKING AND POSSIBLE IDENTIFICATION FROM THE NATURE OF THEIR RESPECTIVE EMISSIONS. AN EXPERIMENT USING ONLY THREE MAGNETOMETERS AND A GROUND VEHICLE IS PROPOSED DURING PHASE I TO DEMONSTRATE THE FEASIBILITY OF THE SCHEME. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - PROPOSED MAGNETIC ARRAY SCHEME WILL HAVE SEVERAL COMMERCIAL APPLICATIONS THAT INVOLVE EARTH RESOURCE SURVEY, GEOPHYSICAL MONITORING, ETC. MOST SIGNIFICANT APPLICATION IS THROUGH VARIOUS DOD AGENCIES. THE CONCEPT COULD BE USED FOR DETECTION, TRACKING AND IDENTIFICATION OF VARIOUS OBJECTS RANGING FROM MINES TO MISSILES.

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Topic#: 91-149 ID#: 9121028
Office: LSO
Contract #: DAAH0192CR159
PI: RAMAS RAMAN
Title: A NOVEL NEAR-NET SHAPE PROCESS TO FABRICATE HEAVY ALLOY LINERS
Abstract: CURRENT PROCESSING SCHEMES OF COLD FORGING AND MACHINING TO FORM HEAVY METAL SHAPE CHARGE LINERS REQUIRE HOURS OF MACHINING, RESULTING IN ALMOST 90% OF THE MATERIAL WASTED, AND LEADS TO SIGNIFICANT COST PENALTIES. THE FEASIBILITY OF A NOVEL NEAR-NET SHAPE PROCESSING SCHEME WILL BE EVALUATED IN PHASE I. THIS PROPOSED APPROACH HAS THE POTENTIAL TO INCREASE PERFORMANCE TO DENSITY LAW LEVELS, WHILE REDUCING FABRICATION COSTS BY 50%. THIS NEAR-NET SHAPE FORMING TECHNOLOGY HAS THE ADDITIONAL FLEXIBILITY TO FABRICATE MULTI-METAL LINERS AND OTHER LINER SHAPES. IN A TEAMING ARRANGEMENT WITH CRT, INC. IN PHASE I, 12 HEAVY METAL LINERS WILL BE FABRICATED USING THE CRT LINER DESIGN, WHICH WILL BE CHARACTERIZED FOR MICROSTRUCTURAL AND MECHANICAL PROPERTIES, AND COMPARED WITH THE CRT DATABASE ON CURRENT STATE-OF-THE-ART MATERIAL. IN PHASE II LARGER SIZE LINERS WILL BE PRODUCED, MECHANICALLY TESTED AND JET CHARACTERIZATION STUDIES WILL BE CARRIED OUT. IN PHASE III, A COMMERCIAL MANUFACTURING FACILITY WILL BE INSTALLED TO IMPLEMENT THE MANUFACTURING OF LINERS USING THIS DESIGN AND PROCESS. THE MAJOR BENEFIT OF THE PROPOSED APPROACH IF SUCCESSFUL, WOULD BE TO ACHIEVE SIGNIFICANT REDUCTION IN A NUMBER OF PROCESSING STEPS, AND MACHINING TIME, LEADING TO MAJOR REDUCTION IN FABRICATION COSTS. SIGNIFICANT SPIN-OFF APPLICATIONS OF THIS TECHNOLOGY IN OTHER DOD APPLICATION AREAS SUCH AS TUNGSTEN AND MOLYBDENUM FOR GUN BARREL LINERS, AND IN COMMERCIAL AREAS SUCH AS FABRICATING

NEAR-NET SHAPE FORGING DIES ARE ALSO LIKELY.

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Topic#: 91-178 ID#: 9120400
Office: ESTO
Contract #: DAAH0192CR016
PI: ANANTHA KRISHNAN
Title: VIRTUAL PROTOTYPING TOOLS FOR SEMICONDUCTOR FABRICATION EQUIPMENT
Abstract: THE EXISTING METHODOLOGY OF DESIGN AND FABRICATION OF SEMICONDUCTOR MANUFACTURING EQUIPMENT IS AN EXPENSIVE AND TIME CONSUMING PROCESS. TO KEEP PACE WITH THE RAPIDLY ADVANCING SEMICONDUCTOR INDUSTRY, IT IS NECESSARY TO DEVELOP A COMPUTER BASED ENVIRONMENT TO QUICKLY SIMULATE THE FEATURES OF THE MANUFACTURING EQUIPMENT BEFORE IT IS TURNED INTO A PHYSICAL PROTOTYPE. APART FROM ACHIEVING CONSIDERABLE SAVING IN TIME AND EXPENSE, VIRTUAL PROTOTYPING HAS THE ADDED ADVANTAGE OF BEING ABLE TO OPTIMIZE THE ENTIRE PROCESS. THE GOAL OF THIS PROJECT IS TO INTEGRATE EXISTING SOFTWARE TOOLS FROM CAD/CAM, CFD, STRUCTURAL MECHANICS, COMPUTER GRAPHICS AND EXPERT SYSTEMS IN ORDER TO DEVELOP AN ENVIRONMENT CAPABLE OF SUPPORTING SYSTEMS LEVEL SIMULATION. IN PHASE I, A REVIEW WILL BE CONDUCTED TO ASSESS THE EXISTING SOFTWARE PACKAGES IN THE RELEVANT DISCIPLINES. THE CRITERIA FOR ASSESSMENT WILL BE THE CAPABILITY OF THE PACKAGE TO MODEL COMPLEX PROCESSES AS WELL AS ITS COMPATIBILITY IN AN INTEGRATED ENVIRONMENT. ALSO, A PRELIMINARY DEMONSTRATION OF CAD/CAM-CFD-GRAPHICS INTEGRATION WILL BE CARRIED OUT ON A TYPICAL CVD REACTOR. PHASE II WILL INVOLVE FURTHER INTEGRATION OF SELECTED PACKAGES AND DESIGN OF A VIRTUAL PROTOTYPE OF A CVD REACTOR. THE UTILITY OF THIS APPROACH WILL BE DEMONSTRATED IN COLLABORATION WITH ONE OF THE MANUFACTURERS OF SEMICONDUCTOR PROCESS EQUIPMENT. VIRTUAL PROTOTYPING WILL ELIMINATE THE NECESSITY FOR TIME CONSUMING AND PROHIBITIVELY EXPENSIVE EXPERIMENTATION WITH HARDWARE. DESIGNS CAN BE OPTIMIZED BEFORE THEY ARE TURNED INTO PHYSICAL PROTOTYPES.

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Topic#: 91-208 ID#: 9121151
Office: SSTO
Contract #: DAAH0192CR183
PI: WILLIAM BRODIE
Title: LISP TO ADA TRANSLATOR - A TOOL FOR TRANSLATING LISP APPLICATIONS INTO CLEAN, READABLE, EFFICIENT ADA APPLICATIONS
Abstract: THIS PROPOSAL'S RESEARCH HOPES TO APPLY SEVERAL OF CHESTNUT SOFTWARE'S PROPRIETARY TRANSLATION TECHNIQUES TO THE PROBLEM OF LISP TO ADA TRANSLATION. LISP IS OFTEN THE DESIRED DEVELOPMENT LANGUAGE FOR COMPLEX PROGRAMMING PROBLEMS. IT IS A FEATURE-RICH LANGUAGE WHICH ALLOWS PROGRAMMERS TO SOLVE DIFFICULT AND COMPLEX PROBLEMS IN THE SHORTEST PERIOD OF TIME. HOWEVER, THESE VERY FEATURES MAKE IT A DIFFICULT LANGUAGE FOR DEPLOYMENT. CHESTNUT HAS ADDRESSED THE PROBLEM OF TRANSLATION OF HIGH-LEVEL PROGRAMMING LANGUAGES WHEN IT DEVELOPED ITS OWN LISP TO C TRANSLATOR. WE NOW HOPE TO PROVE THAT MANY OF THE TECHNIQUES WE HAVE PIONEERED CAN BE APPLIED TO PRODUCING A LISP TO ADA TRANSLATOR. WE WILL EXPLORE HOW MANY OF THE UNIQUE FEATURES OF LISP APPLICATIONS COULD BE REPRESENTED IN ADA. THE GOAL IS TO PRODUCE A TOOL WHICH WOULD TAKE A LISP APPLICATION AND TRANSLATE IT INTO A CLEAN, READABLE, EFFICIENT, SYNTACTICALLY CORRECT ADA APPLICATION. PHASE I WILL HOPE TO DEMONSTRATE THE FEASIBILITY OF THE PROJECT AND LAY FOUNDATION FOR PHASE II. PHASE II WILL RESULT IN A PROTOTYPE OF A SYSTEM WHICH WILL TRANSLATE LISP INTO ADA. A LISP TO ADA TRANSLATOR WOULD PROVIDE DARPA WITH THE OPPORTUNITY TO DEPLOY OR EMBED EXISTING LISP APPLICATIONS INTO ANY CURRENT OR FUTURE ADA SYSTEM. IT WILL ALSO PRESENT THE AGENCY WITH THE OPPORTUNITY OF DEVELOPING FUTURE APPLICATIONS IN ONE OF THE MOST POWERFUL PROGRAMMING ENVIRONMENTS (LISP), WHILE DEPLOYING THEM IN THE DEPARTMENT OF DEFENSE STANDARD, ADA.

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Topic#: 91-043 ID#: 9110506
Office:
Contract #: DAAH0191CR213
PI: STANLEY SCHWARTZ

Title: ARTIFACT-DESIGN/ENGINEERING KNOWLEDGE ONTOLOGY (ART-DEKO) TOOLSET

Abstract: THE PROPOSED EFFORT INITIATES RESEARCH TO DEVELOP A SET OF KNOWLEDGE REPRESENTATION TOOLS ADDRESSING THE UNIQUE NEEDS OF INTERDISCIPLINARY TEAMS OF DOMAIN EXPERTS WHO DESIRE TO CREATE AND MAINTAIN SHARED KNOWLEDGE BASES. THE PROPOSED ART-DEKO (ARTIFACT-DESIGN/ENGINEERING KNOWLEDGE ONTOLOGY) TOOLSET WILL PROVIDE INTELLIGENT ASSISTANCE AND MEDIATION TO EXPERTS IN THE COOPERATIVE PROCESS OF DEFINING A COMMON VOCABULARY OF ENTITIES AND RELATIONSHIPS FOR REPRESENTING AREAS OF OVERLAPPING DOMAIN KNOWLEDGE. THE ART-DEKO TOOLSET INCORPORATES AN INNOVATIVE PLATFORM-INDEPENDENT GRAPHICAL INTERFACE THAT WILL ALLOW DOMAIN EXPERTS TO DIRECTLY EXPRESS THEIR MENTAL MODELS IN TERMS OF ONE OF SEVERAL KNOWLEDGE REPRESENTATION FORMALISMS WITHOUT REQUIRING A KNOWLEDGE ENGINEER TO ACT AS INTERMEDIARY. THE TOOLSET WILL CONTAIN PRECONSTRUCTED ONTOLOGICAL FORMALISMS SPECIFICALLY INTENDED FOR TEAMS OF ARTIFACT DESIGNERS, BUT WILL BE FLEXIBLE ENOUGH TO ASSIST KNOWLEDGE BASE CONSTRUCTION AND MAINTENANCE ACROSS A WIDE VARIETY OF INTERDISCIPLINARY PROBLEM-SOLVING EFFORTS. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE ART-DEKO TOOLSET WILL PROVIDE VALUABLE ASSISTANCE TO INTERDISCIPLINARY DESIGN TEAMS WHO WISH TO COORDINATE THEIR PROBLEM-SOLVING EFFORTS IN THE FORM OF SHARED KNOWLEDGE BASES, SINCE IT WILL UNIQUELY COMBINE A GRAPHICAL INTERFACE FOR UNASSISTED KNOWLEDGE REPRESENTATION BY DOMAIN EXPERTS WITH AN INTELLIGENT MEDIATOR TO ASSIST IN THE DEVELOPMENT OF SHARED ONTOLOGIES.

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Topic#: 91-082 ID#: 9110034
Office:
Contract #: DAAH0191CR245
PI: RICHARD ALTES

Title: STATISTICAL ANALYSIS OF OVERT AND COVERT DATA TO ASSESS LIKELIHOOD OF CBW MANUFACTURE AT A GIVEN...

Abstract: MANY OBSERVABLE FEATURES CAN BE USED TO ASSESS THE LIKELIHOOD THAT A GIVEN MANUFACTURING FACILITY IS ENGAGED IN CBW PRODUCTION. MOST OF THESE FEATURES HAVE RELATIVELY SMALL DISCRIMINATION POWER, AND A MIXTURE OF ORDERED, QUALITATIVE OBSERVATIONS (ORDINAL DATA) AND QUANTITATIVE (RATIO) DATA ARE AVAILABLE. STATISTICAL ANALYSIS OF SUCH FEATURES INVOLVES COMBINING ORDINAL AND RATIO DATA SO AS TO OBTAIN A MEASURE OF WHETHER CERTAIN SITES SHOULD BE MORE CLOSELY INSPECTED FOR POSSIBLE TREATY VIOLATIONS. THE ANALYSIS METHOD SHOULD INCORPORATE EXPERT KNOWLEDGE FROM EXPERIENCED ANALYSTS, AND THE FEATURE SET SHOULD BE EXPANDABLE TO INCLUDE NEW INSIGHTS CONCERNING ALTERNATIVE MANUFACTURING PROCESSES AND THEIR OBSERVABLE CHARACTERISTICS. A PC-BASED PATTERN RECOGNITION SYSTEM IS TO BE CONSTRUCTED AND TESTED WITH SIMULATED OR ACTUAL OBSERVATIONS TO SOLVE THE STATISTICAL ANALYSIS PROBLEM. THE SYSTEM IS TO INCORPORATE HUMAN EXPERT KNOWLEDGE VIA FEATURE DEFINITION AND FEATURE PRIOR PROBABILITY DISTRIBUTIONS THAT CAN BE UPDATED WITH NEW TRAINING DATA. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE PATTERN RECOGNITION SYSTEM CAN BE USED FOR INDUSTRIAL MONITORING FOR ENVIRONMENTAL TREATY VERIFICATION AND NARCOTICS INVESTIGATION. IT ALSO APPLIES TO SAFETY EVALUATIONS OF LARGE SYSTEMS LIKE COMMERCIAL AIRCRAFT AND TO MARKET ANALYSIS ON THE BASIS OF OBSERVED FEATURE VALUES.

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Topic#: 91-001 ID#: 9110487
Office:
Contract #: DAAH0191CR246
PI: CHARLES HENDERSON

Title: DEVELOPMENT OF A COMPACT 2 UM COHERENT LASER RADAR VIBRATION SENSOR

Abstract: REMOTE SENSING OF VIBRATIONS USING COHERENT LASER RADAR (CLR) HAS BEEN IDENTIFIED AS A MEANS OF IDENTIFYING REMOTE TARGETS BY ANALYSIS OF CHARACTERISTIC VIBRATION SPECTRA. CO2 LASER TECHNOLOGY HAS BEEN USED IN EFFORTS UP TO THE PRESENT. RECENT ADVANCES IN EYESAFE (1.4 UM) SOLID-STATE LASER AND LASER RADAR TECHNOLOGY POINT TO A MORE SENSITIVE, COMPACT, SHORTER WAVELENGTH ALTERNATIVE, HIGHLY COMPATIBLE WITH THE REQUIREMENTS OF A RUGGEDIZED REMOTE VIBRATION SENSOR. IN PARTICULAR, A TM,HO:YAG CLR HAS RECENTLY BEEN DEMONSTRATED BY RESEARCHERS AT COHERENT TECHNOLOGIES, INC. TO BE A VERY SENSITIVE, LONG-RANGE EYESAFE SYSTEM OPERATING AT 2.1 UM WAVELENGTH. OPERATION AT THIS WAVELENGTH WOULD RESULT IN A MINIMUM DETECTABLE VIBRATION AMPLITUDE OF ROUGHLY ONE-FIFTH THAT OF A COMPARABLE CO2 SYSTEM. RAPID ADVANCES IN DIODE-PUMPED 2 UM LASER TECHNOLOGY AT CTI AND ELSEWHERE STRONGLY SUGGEST THAT A HIGH POWER, CW SINGLE-FREQUENCY TM,HO:YAG TRANSMITTER IS FEASIBLE HAVING THE OUTPUT POWER AND FREQUENCY STABILITY REQUIRED FOR VIBRATION SENSING APPLICATIONS. THIS PHASE I EFFORT WILL DETERMINE THE PRELIMINARY DESIGN OF A 2 UM COHERENT VIBRATION SENSOR AND DEMONSTRATE A HIGH POWER (1-2W CW) DIODE-PUMPED TRANSMITTER PROTOTYPE. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - NUMEROUS MILITARY AND COMMERCIAL APPLICATIONS EXIST FOR A COMPACT, EFFICIENT EYESAFE REMOTE VIBRATION SENSOR. MACHINE VIBRATION ANALYSIS IN INDUSTRIAL ENVIRONMENTS WOULD DIRECTLY BENEFIT FROM THE PROPOSED INSTRUMENT. SIMILAR TRANSMITTERS EMPLOYING PULSED OPERATION WOULD FIND IMMEDIATE USE IN HELICOPTER WIRE AVOIDANCE, METEOROLOGICAL RESEARCH, ON-BOARD WIND SHEAR AVOIDANCE, POLLUTION MONITORING, AND GROUND-BASED WIND SENSING SYSTEMS.

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Topic#: 91-064 ID#: 9110829
Office:
Contract #: DAAH0191CR247
PI: PAUL J.M. SUNI

Title: A MINIATURIZED, LOW COST, 1.5 UM COHERENT LASER RADAR SYSTEM BASED ON DIODE LASERS

Abstract: COHERENT TECHNOLOGIES, INC. HAS RECENTLY DEMONSTRATED THAT A 2 UM COHERENT LASER RADAR (CLR) OPERATING AT 1 MJ/PULSE WITH A 16 CM BEAM DIAMETER, IS CAPABLE OF PERFORMING HARD TARGET RANGE AND VELOCITY MEASUREMENTS TO AT LEAST 50 KM. SCALING THESE RESULTS TO 50 UJ/PULSE AND A 5 CM TELESCOPE INDICATE THAT RANGE RESOLVED VELOCITY MEASUREMENTS TO RANGES OF SEVERAL MK SHOULD BE FEASIBLE. WE BELIEVE THAT REACHING SUCH A PULSE ENERGY CAN BE ACHIEVED BY AMPLIFYING A NARROW-BANK 1.53 UM LASER DIODE SIGNAL IN AN ERBIUM-DOPE FIBER AMPLIFIER. THE RESULT WOULD BE A VERY COMPACT, BATTERY-OPERABLE EYESAFE CLR WITH A USEFUL RANGE OF SEVERAL KM. A DEVICE OF THIS TYPE COULD FIND MANY USES IN MILITARY AS WELL AS COMMERCIAL APPLICATIONS. THIS PHASE I EFFORT WILL ESTABLISH THE FEASIBILITY OF THE CONCEPT. TO DO SO WE WILL INVESTIGATE AND MODEL ALL SUBSYSTEMS AND ENSURE THAT DEVICES MEETING THE REQUIREMENTS CAN BE DEVELOPED. WE WILL ALSO PERFORM FIELD MEASUREMENTS AT 2 UM TO DEMONSTRATE THAT SUFFICIENT RANGE CAPABILITY CAN BE ACHIEVED. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - A LARGE NUMBER OF MILITARY AND COMMERCIAL APPLICATIONS EXIST FOR COMPACT,EYESAFE, VELOCITY MEASURING DEVICES. MILITARY APPLICATIONS INCLUDE REMOTE RANGE AND VELOCITY MEASUREMENT OF AIRCRAFT AND VEHICLES. COMMERCIAL USES INCLUDE CAR SPEED MONITORING, MONITORING SPORTS EVENTS, AND AUTOMOTIVE USES IN WARNING DEVICES AND AUTOMATIC BRAKE SYSTEMS.

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Topic#: 91-054 ID#: 9110367
Office:
Contract #: DAAH0191CR214
PI: B. COLDING

Title: ADAPTIVE SYSTEM FOR PRECISION CONTROL AND OPTIMIZATION OF MACHINING CELLS

Abstract: COLDING INTERNATIONAL CORPORATION WITH SUBCONTRACT TO THE UNIVERSITY OF MICHIGAN PROPOSES TO DEVELOP A COMPLETE ADAPTIVE OPTIMIZATION SYSTEM FOR BOTH SINGLE MACHINE TOOL AND MACHINING CELLS. THE SYSTEM WILL INCREASE THE PART DIMENSIONAL ACCURACY BY AT LEAST 10:1 AND IMPROVE SURFACE FINISH BY 2:1, YET INCREASING PRODUCTIVITY BY 50%, AND BE ABLE TO OPTIMIZE AND BALANCE THE CELL PRODUCT FLOW TO ACHIEVE A 30% REDUCTION OF TOTAL PART PROCESSING TIME. TOOL BREAKAGE WILL BE DETECTED WITHIN 1 MSECOND OR LESS. THE SYSTEM, BEING A MERGER OF PROTOTYPES OF COLDING INTL. AND THE UNIVERSITY OF MICHIGAN, IS CHARACTERIZED BY A DECISION SUPPORT SYSTEM AS AN INTEGRATION TOOL FOR SENSOR-BASED ENHANCED PRECISION SYSTEM FOR INCREASED DIMENSIONAL ACCURACY AND SURFACE QUALITY OF ANY METAL CUTTING PROCESS. THE SYSTEM WILL INCLUDE TOOL BREAKAGE DETECTION AND WILL OPTIMIZE PRODUCTIVITY BY APPLYING REACTIVE TOOL CHANGING STRATEGIES TO BOTH ROUGHING AND FINISHING OPERATIONS. A CUTTING FORCE DYNAMOMETER, MEASURING AT LEAST THE MAIN CUTTING FORCE AND THE FEED FORCE, WILL BE USED FOR ON-LINE TOOL WEAR COMPENSATION, AS WELL AS FOR TOOL BREAKAGE DETECTION. THE CUTTING FORCE AND A DISPLACEMENT TRANSDUCER WILL COMPENSATE FOR VIBRATIONS. AN ON-LINE MACHINE TOOL TEMPERATURE SENSOR WILL BE USED FOR THERMAL COMPENSATION, AND A LASER INTERFEROMETER FOR OFF-LINE MACHINE TOOL GEOMETRIC COMPENSATION. AN EXISTING LARGE DATABASE FOR CALCULATION OF TOOL-LIFE AND THE CUTTING FORCES WILL GENERATE INITIAL VALUES AS WELL AS VALUES AFTER COMPENSATION. THE SYSTEM OF SOFTWARE ALGORITHMS WILL IN PHASE 2 BE IMPLEMENTED ON THREE EXISTING MACHINE TOOLS (INCLUDING SENSORS) IN THE LABORATORIES OF THE UNIVERSITY OF MICHIGAN.

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Topic#: 91-021 ID#: 9110742
Office:
Contract #: DAAH0191CR291
PI: MURAT ERON

Title: PROCESS AND PHYSICS-BASED MESFET MODELS

Abstract: COMPACT SOFTWARE PROPOSES TO DEVELOP PHYSICS-BASED MESFET, HEMT AND HBT MODELS AND THEN INTEGRATE THEM INTO OUR COMMERCIAL MICROWAVE NONLINEAR CIRCUIT SIMULATOR, "MICROWAVE HARMONICA." EXISTING EXTRACTION BASED MODELS SUCH AS THE MODIFIED MATERKA AND CURTICE MODELS ARE BASED ON MICROWAVE MEASUREMENT INFORMATION. THE USE OF PHYSICS OR PROCESS-BASED MODELS COMPLETES THE ANALYSIS CHAIN BY LINKING PROCESS PARAMETER VARIATIONS TO DEVICE ELECTRICAL CHARACTERISTICS TO CIRCUIT PERFORMANCE AND YIELD. THIS ENABLES THE FOUNDRY PROCESS SENSITIVITIES TO BE UNDERSTOOD AND PROPERLY CORRELATED WITH THE CIRCUIT PERFORMANCE AND YIELD. SUCH INFORMATION CAN BE USED TO IMPROVE CIRCUIT YIELD FOR A GIVEN PROCESS (I.E., DESENSITIZE THE CIRCUIT DESIGN TO A GIVEN FOUNDRY PROCESS) OR TO IDENTIFY CERTAIN PROCESS PARAMETERS WITH A VIEW TOWARD IMPROVING THESE SELECTED PROCESSES AND THEREBY INCREASE THE CIRCUIT YIELD. IN ADDITION, AN ACCURATE PHYSICS-BASED MODEL WILL PERMIT MODELING AND PERFORMANCE PREDICTION OF MM-WAVE DEVICES PRIOR TO FABRICATION. THE PROPOSED PHASE I WORK WILL INVESTIGATE THE OPTIMUM INTERFACE AND VALIDITY OF A SMALL SIGNAL CLOSED-FORM MESFET MODEL WITHIN MICROWAVE HARMONICA. THE PHASE II WORK WILL EXTEND THIS INITIAL INVESTIGATION INTO THE FOLLOWING AREAS: 1) LARGE SIGNAL MESFET MODELS, 2)LARGE AND SMALL SIGNAL HEMT MODELS, 3) LARGE AND SMALL SIGNAL HBT MODELS. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE ANTICIPATED BENEFITS OF THIS EFFORT ARE AS FOLLOWS: 1) THE INTEGRATION OF PHYSICS-BASED MESFET, HEMT AND HBT MODELS INTO AN EXISTING MICROWAVE COMMERCIAL NONLINEAR SIMULATOR, MICROWAVE HARMONICA; 2) ANALYSIS OF THE LINKAGE BETWEEN PROCESS PARAMETERS TO DEVICE CHARACTERISTICS TO CIRCUIT PERFORMANCE AND YIELD; 3) A DETAILED "CASE STUDY" OF A PRODUCTION MMIC CIRCUIT; 4) ESTABLISHMENT OF CLOSER

TIES BETWEEN COMMERCIAL SIMULATORS AND PHYSICS-BASED MESFET/HEMT/HBT MODELLING EFFORTS.

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Topic#: 91-078 ID#: 9110624
Office:
Contract #: DAAH0191CR267
PI: PHILLIP ALVELDA

Title: A NEURAL TECHNOLOGY SMART SENSOR FOR SATELLITE ATTITUDE DETERMINATION

Abstract: THE OBJECTIVE OF THIS INVESTIGATION IS TO DESIGN AND CHARACTERIZE A PROTOTYPE NEURAL TECHNOLOGY SENSORY SYSTEM, A "SMART SENSORY RETINA," TO PERFORM SATELLITE AND SPACECRAFT ATTITUDE DETERMINATION BY STAR PATTERN IDENTIFICATION. THE PROPOSED SENSOR CHIP IS CALLED A RETINA BECAUSE, LIKE BIOLOGICAL RETINAS, IT COMBINES OPTICAL TRANSDUCTION AND PREPROCESSING WITHIN A SINGLE ANALOG COMPUTING SURFACE. THE OUTPUT OF THE SMART RETINA IS A TRANSLATIONALLY AND ROTATIONALLY INVARIANT SIGNAL WHICH CAN BE USED FOR PATTERN IDENTIFICATION AND ATTITUDE CORRELATION. A FULLY INTEGRATED CHIP WHICH IMPLEMENTED THE RETINA AND IDENTIFICATION ALGORITHM IN SUBTHRESHOLD ANALOG VLSI COULD REPLACED AT THE FOCAL PLANE OF A SIMPLE OPTICAL SYSTEM AND DIRECTLY OUTPUT STAR LABELS AND COARSE-ASPECT BORESIGHT ATTITUDE. THE DEVICE WOULD INITIALLY HAVE AN ULTRA-LOW CHIP COUNT DOMINATED BY INTERFACE CIRCUITRY, ULTRA-LOW MASS DOMINATED BY THE OPTICAL SYSTEM (A TWO ORDER OF MAGNITUDE SAVING) AND ULTRA-LOW POWER DISSIPATION ALSO DOMINATED BY INTERFACE CIRCUITRY (A SIX ORDER-OF-MAGNITUDE SAVING). LATER GENERATION FABRICATION AND PROTOTYPING SUPPORTED BY FOLLOW-ON FUNDING WOULD INTEGRATE INTERFACE, SENSORY, AND PATTERN IDENTIFICATION CIRCUITRY TO RESULT IN A SINGLE-CHIP DEVICE. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE PRELIMINARY ANALYSIS AND SIMULATION RESULTS PRESENTED IN THE FOLLOWING PROPOSAL DOCUMENT SHOW THIS NOVEL DISTRIBUTED ANALOG COMPUTATION APPROACH TO PROVIDE AN ENABLING LEAP IN AEROSPACE ELECTRONIC TECHNOLOGY. THE PROMISED SAVINGS IN MASS, POWER AND FUNCTIONALITY ARE PRECISELY THE CHARACTERISTICS WHICH ARE REQUIRED IN AUTONOMOUS SATELLITE SENSORS IN GENERAL AND LOW-MASS HIGH-MANEUVERABILITY SDI WEAPON SYSTEMS IN PARTICULAR (E.G., BRILLIANT PEBBLES).

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Topic#: 91-003 ID#: 9110454
Office:
Contract #: DAAH0192CR099
PI: WILLIAM NULTY

Title: INTERACTIVE DISTRIBUTED LOGISTICS NETWORK SIMULATION

Abstract: THE GOAL OF THIS PROJECT IS TO DEVELOP CONCEPTS FOR A "META" LANGUAGE WHICH WILL ALLOW EFFICIENT CONSTRUCTION OF DISTRIBUTED GAMING SIMULATIONS OF LOGISTICS NETWORKS. BY DEVELOPING THE MODELING OBJECTS AND TOOLS FOR A META LANGUAGE, WE WILL BE ABLE TO QUICKLY DEVELOP GAMING SIMULATIONS WHICH FAITHFULLY REPRODUCE THE ACTUAL LOGISTICS ENVIRONMENT. OUR INTENT IS TO DESIGN A VERY HIGH LEVEL LANGUAGE THAT IS FLEXIBLE AND ROBUST ENOUGH TO ALLOW THE ACCURATE AND COST-EFFICIENT REPLICATION OF THE DIVERSE LOGISTICS FUNCTIONS FOUND IN COMBINED ARMS WARFARE. IT IS ENVISIONED THAT MANY OF THE DATA OBJECTS AND THE GRAPHICAL INTERFACE WILL PARALLEL THAT OF THE CAPS LOGISTICS TOOLKIT/TM, A META LANGUAGE THAT WE HAVE DEVELOPED FOR DESIGN AND OPTIMIZATION OF LOGISTICS NETWORKS. WE WILL DEVELOP AND PROTOTYPE NEW CONCEPTS FOR SIMULATING MOVEMENT OF TRANSPORTATION ASSETS, PERSONNEL, RESUPPLY, AND MAINTENANCE. WE WILL ALSO INCLUDE THE ABILITY TO INTERACTIVELY GENERATE AND DYNAMICALLY MODIFY ASSIGNMENT AND SCHEDULING OF MATERIAL MOVEMENTS, TRANSPORTATION ASSETS, AND OTHER RESOURCES OR FACILITIES RELEVANT TO THE LOGISTICS NETWORK. THE RESULTING META LANGUAGE WILL SUPPORT SIMULTANEOUS INTERACTIVE SIMULATIONS FOR PERSONNEL TRAINING, WAR GAMING, AND DEVELOPING INSIGHT INTO LOGISTICS NETWORK BEHAVIOR. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - META LANGUAGE SOFTWARE TO SUPPORT CONSTRUCTION OF DISTRIBUTED GAMING SIMULATIONS OF LOGISTICS NETWORKS WILL HAVE IMMEDIATE

APPLICATION IN BOTH THE PUBLIC AND PRIVATE SECTOR. MILITARY PLANNERS WILL BE ABLE TO DEVELOP COST-EFFICIENT APPLICATION QUICKLY FOR TRAINING AND EDUCATION PURPOSES IN MANY AREAS INCLUDING DEPLOYMENT PLANNING AND LOGISTICAL SUPPORT OF COMBINED ARMS WARFARE. NON-MILITARY APPLICATIONS INCLUDE UNIVERSITY AND PRIVATE SECTOR EDUCATION AS AN AID TO GENERAL INSIGHT INTO THE DESIGN AND EXECUTION OF A LOGISTICS NETWORK.

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Topic#: 91-183 ID#: 9120155
Office: CSTO
Contract #: DAAH0192CR138
PI: VINOD LOBO

Title: DEVELOPING THE MODULAR MULTIMEDIA COURSEWARE SYSTEM: A STANDARD AND TOOLSET FOR IMPLEMENTING INTERACTIVE MULTIMEDIA COUR

Abstract: INTERACTIVE MULTIMEDIA COURSEWARE COMBINES TRADITIONAL COMPUTER-BASED INSTRUCTION WITH AUDIO-VISUAL PRESENTATION AND A HIGH LEVEL OF STUDENT PARTICIPATION. WITH MULTIMEDIA COURSEWARE, A STUDENT LEARNS BY EXPLORING A SUBJECT IN A PLAYFUL, ENTERTAINING ENVIRONMENT WHICH CAN HEIGHTEN INTEREST AND IMPROVE RETENTION. RECENT ADVANCES IN TECHNOLOGY MAKE MULTIMEDIA COURSEWARE POSSIBLE USING PERSONAL COMPUTERS. HOWEVER, A LACK OF STANDARDS FOR CREATING, DISTRIBUTING, CUSTOMIZING, AND USING MULTIMEDIA COURSEWARE IS LIMITING ITS APPLICATION. THE PROPOSED MODULAR MULTIMEDIA COURSEWARE SYSTEM (MMCS) ESTABLISHES A FRAMEWORK THROUGH WHICH COURSEWARE DEVELOPERS, EDUCATORS, AND STUDENTS CAN UTILIZE INTERACTIVE MULTIMEDIA COURSEWARE. DEVELOPERS CREATE MODULAR MULTIMEDIA LESSONS FOR DISTRIBUTION THROUGH A COMMON COURSEWARE REPOSITORY. EDUCATORS INTEGRATE THE LESSONS INTO CUSTOMIZED COURSES FOR THEIR STUDENTS. THE PHASE I OBJECTIVES ARE 1) TO DESIGN THE MMCS STANDARD WITH COURSEWARE MODULARITY, EASE OF DISTRIBUTION, AND IMPROVED LEARNING CAPABILITIES, AND 2) TO DEVELOP A WORKING MMCS PROTOTYPE TO DEMONSTRATE AND EVALUATE THE SYSTEM. THE WORK EFFORT WILL INVOLVE DEFINING THE MMCS STANDARD, DEMONSTRATING A FUNCTIONAL PROTOTYPE OF THE SYSTEM, DEVELOPING A SAMPLE REPOSITORY OF MODULAR LESSONS, AND EVALUATING THE EFFECTIVENESS OF THE SYSTEM. THE MMCS WOULD BENEFIT THE EDUCATIONAL SYSTEM BY FACILITATING THE DEVELOPMENT, DISTRIBUTION, AND USE OF A LARGE REPOSITORY OF STANDARD INTERACTIVE MULTIMEDIA COURSEWARE. ANY ORGANIZATION CAN UTILIZE THE MMCS TO DELIVER EDUCATION AND TRAINING MATERIALS IN A MODULAR, STANDARDIZED FORMAT.

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Topic#: 91-149 ID#: 9120904
Office: LSO
Contract #: DAAH0192CR142
PI: BRIAN HIBBARD

Title: COLD-FLOW PROCESSING OF MOLYBDENUM SHAPED CHARGE LINERS

Abstract: CURRENT RESEARCH SUGGESTS THAT PERFORMANCE INCREASES ARE POSSIBLE BY USING LINERS OF HEAVIER METALS IN WARHEADS. THERE NEEDS TO BE AN EFFORT TO DEVELOP NOVEL METHODS FOR FORMING LINERS FROM CERTAIN HEAVY METALS. THE PHASE I TECHNICAL OBJECTIVES WILL BE TO PROVE THAT COUSINO'S COLD-FLOWING PROCESS IS A COMPETITIVE AND VIABLE TECHNIQUE FOR THE MANUFACTURE OF MOLYBDENUM SHAPED CHARGES. THIS EFFORT PROPOSES TO MANUFACTURE TWELVE SHAPED CHARGES TO NET SIZE PER THE 81MM DESIGN SUPPLIED BY THE DEFENSE ADVANCED RESEARCH PROJECTS AGENCY (DARPA). SIX OF THESE LINERS WILL BE PRODUCED FROM PURE MOLYBDENUM WHILE THE REMAINING PIECES WILL BE CREATED USING A MOLYBDENUM-RHENIUM ALLOY. THESE PARTS WILL BE SUBMITTED TO DARPA FOR TEST FIRING EVALUATION. IN ADDITION, COUSINO WILL IMPLEMENT X-RAY DIFFRACTION ANALYSIS TO SHOW THE BASIC ENHANCEMENTS IN MATERIAL PROPERTIES SUCH AS METALLURGICAL CONSISTENCY AND STRONG PREFERRED GRAIN ORIENTATION (TEXTURE) PRODUCED BY COUSINO'S PROCESS OVER THE MATERIAL PROPERTIES CONTAINED IN BOTH INCOMING BAR STOCK AND PLATE CONDITIONS. A FINAL REPORT CONTAINING THE X-RAY DIFFRACTION AND DIMENSIONAL CHARACTERISTICS RESULTS WILL BE SUBMITTED ALONG WITH THE PARTS UPON COMPLETION OF PHASE

I EFFORTS. DEMAND FOR IMPROVED WARHEAD CAPABILITIES IS ALMOST BEYOND QUANTIFICATION BECAUSE OF THE EVER CHANGING THREATS AND/OR TARGETS. DUE TO THE SUCCESSFUL PERFORMANCE OF SMART MUNITIONS SYSTEMS IN OPERATION DESERT STORM, IT APPEARS THAT THE MARKET WILL REMAIN STABLE FOR THE WEAPON SYSTEMS THAT UTILIZE THE SHAPED CHARGE LINER CONCEPT SUCH AS TOW, HELLFIRE, AND AAWS-M.

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Topic#: 91-178 ID#: 9120161
Office: ESTO
Contract #: DAAH0192CR039
PI: JAMES BARRY
Title: A SOFTWARE MODELING ENVIRONMENT FOR VIRTUAL PROTOTYPING OF SEMICONDUCTOR FABRICATION EQUIPMENT
Abstract: APPLICATION OF SIMULATION AND MODELLING TO THE DESIGN OF SEMICONDUCTOR FABRICATION EQUIPMENT WILL REDUCE DEVELOPMENT TIME AND COSTS AND PROMOTE INNOVATION IN SEMICONDUCTOR MANUFACTURING. THIS PROJECT PROPOSES TO DEMONSTRATE THE FEASIBILITY OF AN INNOVATIVE SOFTWARE ENVIRONMENT FOR VIRTUAL PROTOTYPING OF THIS EQUIPMENT. USING THIS SOFTWARE, DESIGNERS CAN PERFORM CRITICAL MODELLING AND DESIGN TRADES PRIOR TO CONSTRUCTION OF A PHYSICAL PROTOTYPE SYSTEM. THE VIRTUAL PROTOTYPING SOFTWARE WILL INCLUDE AN INTUITIVE USER INTERFACE, DESIGN DATABASE, AND PROVIDE USER-FRIENDLY ACCESS TO EXISTING TOOLS FOR ANALYSIS OF GAS FLOWS, HEAT TRANSFER, CHEMICAL REACTIONS, PARTICLE TRANSPORT, SYSTEM CONTROL, MECHANICAL DESIGN AND RELIABILITY. THE MAIN OBJECTIVES OF THIS PHASE I PROJECT ARE TO SHOW THAT SUCH A SOFTWARE ENVIRONMENT IS FEASIBLE AND TO LAY THE GROUNDWORK FOR SOFTWARE DEVELOPMENT AND DEMONSTRATION IN PHASE II. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE VIRTUAL PROTOTYPING ENVIRONMENT WILL REDUCE THE COSTS OF SEMICONDUCTORS TO THE DOD BY MAKING DEVELOPMENT OF SEMICONDUCTOR FABRICATION EQUIPMENT FASTER AND LESS COSTLY. NEW CONCEPTS CAN BE TESTED MORE EASILY AND QUICKLY, SPURRING INNOVATION. THE PROGRAM WILL HAVE WIDE APPLICABILITY TO DESIGNERS OF FABRICATION EQUIPMENT FOR BOTH MILITARY AND CIVILIAN SEMICONDUCTOR PRODUCTS.

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Topic#: 91-063 ID#: 9110025
Office:
Contract #: DAAH0191CR203
PI: G.M. LOIACONO
Title: SYNTHESIS, CRYSTAL GROWTH AND CHARACTERIZATION OF TMAL3(BO3)4 FOR MULTI-FREQUENCY LASERS
Abstract: THE TECHNICAL OBJECTIVES OF THIS PROGRAM ARE TO ESTABLISH THE SYNTHESIS AND CRYSTAL GROWTH PARAMETERS REQUIRED TO PRODUCE TMAL3(BO3)4. THE CRYSTALS WILL THEN BE EVALUATED IN TERMS OF STANDARD SPECTROSCOPIC MEASUREMENTS FOR LASER APPLICATIONS. IN PARTICULAR, LINE WIDTHS, LINE STRENGTHS AND FLUORESCENCE LIFETIMES. PRELIMINARY LASING BY PUMPED LASER SOURCES WILL BE EVALUATED. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THERE IS INCREASING NEED FOR COMPACT SOLID STATE LASERS CAPABLE OF MULTI-FREQUENCY OPERATION OVER THE VISIBLE TO INFRARED REGION. THE DEVELOPMENT OF THIS MATERIAL IS OF INTEREST BECAUSE THIS NONLINEAR HAST CAN FORM MONOLITHIC DEVICES FOR PRODUCING LASER EMISSION OVER THIS OPTICAL RANGE.

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Topic#: 91-033 ID#: 9110536
Office:
Contract #: DAAH0191CR233
PI: WILLIAM PHILLIPS
Title: AN INTEGRATED PROCESS FOR PRODUCING COMMERCIAL DIAMOND X-RAY LITHOGRAPHY MASKS

Abstract: CVD DIAMOND MEMBRANES WHICH ARE TRANSPARENT TO VISIBLE LIGHT ARE NOW BEING ROUTINELY PRODUCED AT CRYSTALLUME FOR USE IN X-RAY LITHOGRAPHY. THE PROGRAM DESCRIBED IN THIS PROPOSAL WILL GO BEYOND GENERAL MATERIALS DEVELOPMENT GOALS AND WILL UTILIZE MECHANICAL MODELING TO DETERMINE THE SPECIFIC MEMBRANE/ABSORBER REQUIREMENTS FOR OPTIMAL PERFORMANCE OF DIAMOND MEMBRANE MASKS. USING A PROJECT TEAM INVOLVING CRYSTALLUME, SVG LITHOGRAPHY SYSTEMS, DUPONT PHOTOMASK DIVISION, AND UNIVERSITY OF WISCONSIN, AN INTEGRATED DIAMOND MASK FABRICATION PROCESS WILL BE ANALYZED. IN PARTICULAR, TRADE-OFFS BETWEEN MATERIAL, EQUIPMENT, AND PATTERNING PROTOCOLS WILL BE EXAMINED, THE BEST ABSORBER SYSTEM FOR DIAMOND MEMBRANE MASK WILL BE IDENTIFIED, AND THE ECONOMIC BASIS FOR COMMERCIAL PRODUCTION WILL BE ESTABLISHED. ONCE ESTABLISHED, THIS BASE-LINE PROCESS WILL BE EVALUATED AGAINST DIFFERENT X-RAY LITHOGRAPHY PROCESS ALTERNATIVES AND EQUIPMENT APPROACHES. IN PHASE II, PROTOTYPE MASK SAMPLES WILL BE FABRICATED FOR THIRD PARTY EVALUATION AND CHARACTERIZATION. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - X-RAY LITHOGRAPHY RELIES ON THE EXISTENCE OF A ROBUST, ACCURATE MASK SYSTEM TO TRANSFER PATTERNS TO SILICON AND GAAS SUBSTRATES. DIAMOND IS A LEADING CANDIDATE MATERIAL FOR MEMBRANES USED IN X-RAY MASKS. HOWEVER, IT IS NECESSARY TO EXAMINE THE TRADE-OFFS AMONG VARIOUS ELEMENTS OF THE DIAMOND MASK-MAKING PROCESS. THIS PROJECT WILL PERMIT THE INTEGRATION OF INDIVIDUAL MEMBRANE, PATTERNING, AND STEPPER TECHNOLOGIES INTO A WORKABLE PROCESS SUITABLE FOR COMMERCIAL PRODUCTION.

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Topic#: 91-013
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ID#: 9110651

Title: HIGH QUALITY FABRICATION OF LAMINATED COMPOSITE MATERIALS FOR IMPROVED STRUCTURAL...
Abstract: THE OBJECTIVE OF THIS EFFORT IS TO ESTABLISH PROCESS METHODS AND PARAMETERS NECESSARY FOR INCORPORATING COMPRESSION MOLDING TECHNIQUES IN THE FABRICATION OF LAMINATED COMPOSITES TAILORED TO THE SPECIFIC GEOMETRIC AND STRUCTURAL REQUIREMENTS OF KE PROJECTILES. THIS WORK INVOLVES DESIGN AND ANALYSIS OF TWO REPRESENTATIVE KE PROJECTILE CONFIGURATIONS INCORPORATING LAMINATED COMPOSITE COMPONENTS THAT FUNCTION AS PRIMARY ELEMENTS OF SUPPORT: 1) A LONG ROD PROJECTILE;AND 2) A ROCKET ASSISTED PROJECTILE (RAP). DETAILED PLY-BY-PLY FINITE ELEMENT MODELS OF EACH PROJECTILE CONFIGURATION WILL BE DEVELOPED INCORPORATING MATERIAL MODELS AND GEOMETRIC ASPECTS THAT REPRESENT FABRICATION RELATED PARAMETERS SUCH AS NON-UNIFORM COMPOSITE STIFFNESS ALONG INTERFACES, THROUGH-THE-THICKNESSSTIFFNESS GRADIENTS, AND VARIABLE INTERFACE BEARING CONTACT BETWEEN COMPONENTS. RESULTS FROM ANALYSES OF THESE MODELS WILL BE USED TO GUIDE DEVELOPMENT OF THE PROJECTILE CONFIGURATION DESIGNS AND TO ESTABLISH REQUIRED FABRICATION SPECIFICATIONS REGARDING FIBER STRAIGHTNESS, FIBER ORIENTATION, RESIN VOLUME FRACTION, AND DIMENSIONAL TOLERANCES IN LAYING UP THE COMPOSITE. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - RESULTS FROM THIS WORK WILL HELP TO DEVELOP AN UNDERSTANDING OF THE PRACTICAL LIMITATION ARISING FROM FABRICATION CONSTRAINTS ON DELIVERED PERFORMANCE OF COMPOSITE MATERIALS IN KINETIC ENERGY PROJECTILE APPLICATIONS. POTENTIAL IMPROVEMENTS IN DELIVERED STRENGTH OF COMPOSITE MATERIALS IS A BENEFIT TO ANY APPLICATION IN WHICH WEIGHT AND STRENGTH PLAY AN INTEGRAL ROLE IN THE FINAL DESIGN.

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Topic#: 91-231
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Title: ULTRA LOW COST FUEL CONTROL SYSTEM FOR EXPENDABLE TURBOJET ENGINE
Abstract: THE KEY TO COST REDUCTION OF THE FUEL CONTROL SYSTEM FOR AN EXPENDABLE TURBOJET

ENGINE LIES IN UTILIZING THE PHYSICAL CHARACTERISTICS OF THE GAS TURBINE ENGINE ITSELF, TAKING ADVANTAGE OF EXISTING FEATURES ON BOARD THE MISSILE, AND COMBINING FUNCTIONS AND COMPONENTS AS MUCH AS POSSIBLE. THIS PROPOSAL FOLLOWS SUCH AN APPROACH AND OFFERS SIGNIFICANT REDUCTION IN COMPLEXITY OF THE CONTROL SYSTEM, RESULTING IN SUBSTANTIAL COST AND WEIGHT SAVINGS. IT IS PROPOSED TO DO AWAY WITH THE TRADITIONAL USE OF THE SPEED SENSORS, THERMOCOUPLES, PRESSURE TRANSDUCERS, AND COMPLICATED ELECTRONIC CONTROL UNITS. INSTEAD, MAKE USE OF AN ELECTROHYDRAULIC METERING VALVE, WHICH BY MEANS OF PNEUMATIC FEEDBACK FROM THE ENGINE COMPRESSOR DISCHARGE PRESSURE (PCD) CAN CONTROL THE ACCELERATION AND DECELERATION OF THE ENGINE DURING STARTING AS WELL AS DURING THRUST ADJUSTMENTS. PCD BIAS WILL ALSO PROVIDE AN EFFECTIVE ALTITUDE COMPENSATION. THE FUEL PRESSURE WILL BE PROVIDED BY AN ELASTIC, BLADDER TYPE, ACCUMULATOR; ALSO PRESSURIZED BY PCD. A SIMPLE ANALOG OR DIGITAL MICROCONTROLLER CAN BE USED TO SEQUENCE THE PYROTECHNIC DEVICES DURING START, AND CONVERT THE REQUIRED THRUST SETTINGS INTO SIGNALS FOR THE FUEL METERING VALVE. HOWEVER, BY COMBINING THE ELECTRONIC CONTROL FUNCTIONS WITH THAT OF THE VEHICLE, SUBSTANTIAL COST SAVINGS AND SIMPLIFICATION WILL RESULT. IN ADDITION TO REDUCING COST, THE PROPOSED DESIGN WILL REDUCE THE WEIGHT OF THE FUEL CONTROL SYSTEM RESULTING IN HIGHER THRUST TO WEIGHT RATIO. ALSO, DUE TO THE SIMPLICITY OF THE APPROACH A HIGH RELIABILITY WILL BE ASSURED. ALTHOUGH MOST APPLICATIONS SHALL BE AIMED TOWARD TACTICAL MISSILE USE, PRIVATE AVIATION ENTHUSIASTS HAVE INDICATED INTEREST IN A LOW COST RELIABLE TURBOJET ENGINE FOR SMALL GLIDER PLANE LAUNCHING.

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Topic#: 91-050 ID#: 9110405
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Title: INTELLIGENT NEXT GENERATION CONTROLLER/SENSOR OPERATIONS PLANNING SYSTEMS

Abstract: WE PROPOSE THE DEVELOPMENT OF A MACHINE CONTROLLER/SENSOR PLANNING SYSTEM WHICH COMBINES MATURE VISION-BASED GUIDANCE TECHNOLOGY, STANDARDIZED ROBOTIC MACHINE PLATFORM INTERFACES, AND AN INTERACTIVE PLANNING SYSTEM INTEGRATED INTO A GRAPHICAL ROBOTIC VISUALIZATION SYSTEM. TO SUPPORT ADVANCED MACHINING SYSTEMS OPERATED FROM REMOTELY LOCATED DESIGN CENTERS (AND FOR SMALL LOT QUANTITY MANUFACTURING), THE PROPOSED TECHNOLOGY WILL BE NECESSARY TO ACCOMMODATE RAPID TURN AROUND OPERATIONS. WE ALSO EXPECT THAT AN IMPROVED SENSOR/MACHINE PROGRAMMING ENVIRONMENT WILL SIGNIFICANTLY EXTEND THE CURRENT PLANNED NEXT GENERATION CONTROLLER ACTIVITIES. THE PROPOSED APPROACH BEGINS WITH INCORPORATING CAD-BASED COMPUTER VISION INTO A STANDARDIZED ROBOTIC COMMAND AND CONTROL STRUCTURE (E.G., NASREM-LIKE). THEN STANDARDIZED SIMULATION MODULES WITH EQUIVALENT FUNCTION TO THE STANDARDIZED MACHINE AND SENSOR PROCESSING SUBSYSTEMS CAN BE IMPLEMENTED AND USED (IN PHASE II) BY AN AI PLANNING ENVIRONMENT (AND CONNECT TO A CONVENTIONAL GRAPHICS SYSTEM). WE WOULD EXPECT THE PROPOSED EFFORT TO INTEGRATE GRACEFULLY WITH OTHER INTELLIGENT CONTROLLER DEVELOPMENT ACTIVITIES ALREADY UNDERWAY. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE DEVELOPMENT OF SUCH AN ENVIRONMENT IS IMPORTANT BECAUSE IT FACILITATES MORE DYNAMIC UTILIZATION OF ROBOTS AND MACHINE CONTROLLERS IN MATERIALS HANDLING, HAZARDOUS MATERIALS, AND MANUFACTURING APPLICATIONS. CURRENTLY AVAILABLE MACHINE PLANNING SYSTEMS HAVE LIMITED SUPPORT FOR VISUALIZATION FACILITIES TO SUPPORT SENSOR-BASED OPERATIONS, AND DO NOT PROVIDE SIGNIFICANT LEVELS OF TASK PLANNING AUTOMATION.

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Topic#: 91-028 ID#: 9110675
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PI: JEFF JALKIO

Title: HIGH SPEED PROFILING OF MULTICHIP MODULE INTERCONNECTIONS
Abstract: AS THE COMPLEXITY AND FUNCTIONALITY OF MICROELECTRONIC COMPONENTS INCREASED, STANDARD PACKAGING AND INTERCONNECTION TECHNOLOGIES LIMIT THE DEVELOPMENT OF ELECTRONIC SYSTEMS. TO INCREASE THE DENSITY OF ELECTRONIC COMPONENTS, NEW TECHNIQUES SUCH AS FLIP-CHIP BONDING HAVE BEEN DESIGNED TO ALLOW MULTI-CHIP MODULES. THIS PACKAGING TECHNIQUE IS CURRENTLY LIMITED BY THE YIELD AND RELIABILITY OF THE ELECTRICAL CONTACTS. MISREGISTRATION AND MALFORMED ELECTRICAL CONTACTS ARE PROBABLE WHEN THE NUMBER OF CONTACTS CAN EXCEED SEVERAL HUNDRED PER DIE. IN THIS PROGRAM WE PROPOSE TO INVESTIGATE AND DEVELOP A SYSTEM TO DETECT AND REPAIR DEFECTIVE ELECTRICAL CONTACTS ON FLIP-CHIPS BEFORE BONDING OCCURS. USING A HIGH-SPEED, LASER-BASED, POINT RANGE SENSOR AND A HIGH-SPEED PART TRANSPORT SYSTEM, CRITICAL DIMENSIONAL CHARACTERISTICS OF THE ELECTRICAL CONTACTS CAN BE MEASURED. USING THIS DATE, DEFECTIVE CONTACTS CAN BE IDENTIFIED, REPAIRED OR REPLACED. IN PHASE I OF THIS PROGRAM, WE WILL DEFINE DEFECTS WHICH LIMIT THE BONDING PROCESS, DESIGN AND FABRICATE AN OPTIMIZED HEIGHT SENSOR, DEVELOP ALGORITHMS TO DETERMINE DEFECTIVE CONTACTS AND DESIGN A PROTOTYPE SYSTEM FOR INSPECTING AND REPAIR FLIP-CHIP DIE. PHASE II OF THIS PROGRAM WILL FABRICATE THE INSPECTION AND REPAIR SYSTEM AND INSTALL THE SYSTEM ON A FABRICATION LINE. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - SUCCESSFUL DEVELOPMENT OF AN INSPECTION AND REPAIR STATION FOR ELECTRICAL CONTACTS ON FLIP-CHIP DIE WILL SIGNIFICANTLY INCREASE THE YIELD AND RELIABILITY OF THIS TYPE OF PACKAGING TECHNIQUE. COUPLED WITH THE INCREASE IN YIELD WILL BE A DECREASE IN COST OF THE TECHNIQUE MAKING MULTICHIP PACKAGING TECHNIQUE AVAILABLE FOR A WIDE RANGE OF APPLICATIONS IN SIGNAL PROCESSING, COMMUNICATIONS, IMAGE DETECTION AND COMPUTING.

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Topic#: 91-112 ID#: 9120765
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Contract #: DAAH0192CR181
PI: RICHARD SANDSTROM

Title: IMPROVED 193NM EXCIMER LASER FOR USE IN A LITHOGRAPHY SYSTEM
Abstract: CYMER LASER TECHNOLOGIES PROPOSES TO DEVELOP A PRODUCTION WORTHY ARGON FLUORIDE EXCIMER LASER FOR A 193NM PROJECTION LITHOGRAPHY SYSTEM WHICH WILL BE USED IN THE FABRICATION OF INTEGRATED CIRCUITS WITH FEATURE SIZES AT OR BELOW 0.25 MICRONS. THE LASER WILL OPERATE AT A REPETITION RATE OF > 500 HZ, WITH PULSE-TO-PULSE STABILITY <2%, Lδ, AND AT AN AVERAGE POWER OF 15 W. IN ADDITION, IMPROVEMENTS IN RELIABILITY, AVAILABILITY, AND MAINTAINABILITY (RAM) , AND THE TOTAL COST OF OPERATION WILL BE ADDRESSED. IN PHASE I OF THIS PROGRAM WE WILL FOCUS ON THREE SPECIFIC AREAS OF TECHNOLOGY. 1. IMPROVED GAS FLOW DYNAMICS INSIDE THE LASER IN ORDER TO INCREASE THE REPETITION RATE AND TO IMPROVE THE PULSE-TO-PULSE ENERGY STABILITY. 2. OPTIMIZE THE ELECTRODE PROFILE AND MATERIAL FOR MAXIMUM EFFICIENCY AND LONG ELECTRODE LIFE. 3. OPTIMIZE THE PULSE POWER MODULE, ONCE AGAIN TO MAXIMIZE EFFICIENCY AND IMPROVE THYRATRON LIFE. AT THE CONCLUSION OF PHASE 1 OF THIS PROGRAM, WE WILL DEMONSTRATE, IN A TEST LASER, THE SYSTEM IMPROVEMENTS. WE WILL SHOW HOW THE PROPOSED CHANGES AND LASER SUBSYSTEM OPTIMIZATION WILL LEAD TO A PRODUCTION WORTHY 193NM LASER. THE PURPOSE OF THE PHASE I PROGRAM IS TO PERFORM DETAILED ANALYSIS AND EXPERIMENTS THAT WILL TELL US HOW TO ACHIEVE THE FINAL OBJECTIVE OF THIS PROJECT, NAMELY, BUILD A PRODUCTION WORTHY ARF LASER FOR A PRODUCTION LITHOGRAPHY TOOL. THE BENEFIT OF THE PROGRAM TO DARPA WILL BE THE AVAILABILITY OF A HIGHLY RELIABLE AND PRODUCTION WORTHY ARGON FLUORIDE (193NM) LASER FOR A PROJECTION LITHOGRAPHY SYSTEM. OPTICAL LITHOGRAPHY BASED ON USING A 193NM ARGON FLUORIDE LASER AS THE ILLUMINATION SOURCE PROVIDES THE SIMPLEST AND THE MOST COST EFFECTIVE MEANS TO ACHIEVE SUB 0.25 MICRON DESIGN FEATURES IN VLSI FABRICATION.

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Topic#: 91-243 ID#: 9120038
Office: ASTO
Contract #: DAAH0192CR171
PI: EDWARD ALLEN

Title: FEASIBILITY OF UAV AIRFOIL & CONTROL SURFACE MANUFACTURING USING CONTINUOUS MANUFACTURING MACHINES

Abstract: CONTRACTOR WILL EXAMINE THE FEASIBILITY OF UTILIZING PULTRUSION-TYPE CONTINUOUS TAPE LAYING MANUFACTURING EQUIPMENT TO FABRICATE COMPOSITE SANDWICH STRUCTURE WINGS AND STABILIZERS FOR CLOSE RANGE AND SHORT RANGE CLASS UNMANNED AERIAL VEHICLES. DURING PHASE I A SMALL PROOF-OF-CONCEPT MANUFACTURING MACHINE WILL BE DESIGNED, BUILT, AND EVALUATED. IN ADDITION, THE QUALITY OF THE MANUFACTURED PRODUCT FROM THE TEST MACHINE WILL BE EVALUATED. A FEASIBILITY REPORT WILL BE PREPARED. THE PROPOSED OUTCOME FOR PHASE I IS AN EVALUATION OF THE NOVEL MANUFACTURING MACHINE, AND OF THE RESULTING UAV WING MATERIAL. IN ADDITION, IF THE DEVELOPMENT IS PROMISING, A PRELIMINARY DESIGN FOR A FULL-SCALE MACHINE WILL BE PREPARED. FURTHER APPLICATIONS, COMMERCIAL AND GOVERNMENT, INCLUDE THE FULL RANGE OF UAV PLATFORMS CURRENTLY UNDER DEVELOPMENT AND IN OPERATION.

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Topic#: 91-199 ID#: 9120893
Office: CSTO
Contract #: DAAH0192CR143
PI: ELIZABETH LAGNESE

Title: MULTI-COMPONENT SYNTHESIS THROUGH ARCHITECTURAL PARTITIONING

Abstract: SYSTEM LEVEL DESIGN DECISIONS ARE KEY TO MULTI-COMPONENT SYNTHESIS: THE DETERMINATION OF WHERE TO SPLIT THE FUNCTIONALITY AMONG COMPONENTS HAS A GREAT EFFECT ON THE SIZE AND PERFORMANCE OF THE DESIGN. BY PARTITIONING A BEHAVIOR ONTO SEPARATE MODULES EARLY IN THE DESIGN PROCESS, THE PHYSICAL IMPLICATIONS CAN BE PROPAGATED TO LATER DESIGN STAGES. DASYS PROPOSES TO DEVELOP A TOOL TO AID IN THE DESIGN OF ELECTRONIC SYSTEMS. SUCH A TOOL, OPERATING, OPERATING ON A VHDL BEHAVIOR, AND PRODUCING A PARTITIONED VHDL STRUCTURAL DESIGN, WILL BE EASILY INTEGRATABLE INTO EXISTING CAE TOOLS, AND HAS THE POTENTIAL TO GREATLY IMPROVE THE SYSTEM LEVEL DESIGN PROCESS. SYSTEM LEVEL IC DESIGN TOOLS ARE IN GREAT DEMAND BY INDUSTRIAL SYSTEM DESIGNERS. THE TOOL PROPOSED IN THIS PROJECT WILL AUTOMATE ON OF THE MOST DIFFICULT AND TIME CONSUMING PORTIONS OF THE SYSTEM DESIGN PROCESS: ARCHITECTURAL PARTITIONING. BECAUSE ARCHITECTURAL PARTITIONING OCCURS EARLY IN THE DESIGN PROCESS, IT HAS A GREAT EFFECT ON THE FINAL OUTCOME OF THE DESIGN AND WILL GREATLY IMPROVE DESIGN QUALITY.

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Topic#: 91-027 ID#: 9110823
Office:
Contract #: DAAH0191CR157
PI: MICHAEL MCLENNAN

Title: INTEGRATED TECHNOLOGY COMPUTER AIDED DESIGN

Abstract: THE PROPOSED EFFORT SHALL PRODUCE A DETAILED PLAN FOR IMPLEMENTATION AND DEMONSTRATION OF A SEMICONDUCTOR TCAD (TECHNOLOGY COMPUTER-AIDED DESIGN) FRAMEWORK WHICH BEST MEETS THE PRESENT AND FUTURE NEEDS FOR INTEGRATED OPERATION AND DATA EXCHANGE AMONG DIVERSE SEMICONDUCTOR TCAD TOOLS SPANNING R&D THROUGH MANUFACTURING ENVIRONMENTS. IN ORDER TO BEST DEVELOP THIS PLAN, DAWN TECHNOLOGIES, INC. SHALL ASSESS THE NEEDS OF R&D AND MANUFACTURING ENVIRONMENTS FOR TCAD FRAMEWORKS, EVALUATE EXISTING FRAMEWORK TECHNOLOGY AND EMERGING INDUSTRY STANDARDS FOR APPLICABILITY TO SEMICONDUCTOR TCAD FRAMEWORKS, DEVELOP A DETAILED SET OF REQUIREMENTS FOR SEMICONDUCTOR TCAD FRAMEWORKS, AND DEVELOP A DETAILED SET OF REQUIREMENTS FOR SEMICONDUCTOR TCAD FRAMEWORKS. THE DEMONSTRATION PART OF THE PLAN SHALL INCLUDE

INTEGRATED OPERATION OF TCAD TOOLS FROM DIVERSE COMMERCIAL SOURCES. THE IMPLEMENTATION PART OF THE PLAN SHALL BE BASED ON EXISTING FRAMEWORK SOFTWARE TECHNOLOGY COMBINED WITH DEVELOPMENT OR ENHANCEMENT OF CRITICAL TCAD SPECIFIC SOFTWARE COMPONENTS AND STANDARDS (SUCH AS SEMICONDUCTOR WAFER REPRESENTATION - SWR, AND SEMICONDUCTOR PROCESS REPRESENTATION - SPR) WHICH ARE MOST NEEDED FOR INTEGRATED OPERATION AND DATA EXCHANGE AMONG DIVERSE TCAD TOOLS. THE SELECTION OF EXISTING FRAMEWORK SOFTWARE TECHNOLOGY SHALL EMPHASIZE COMPATIBILITY WITH COMMERCIAL STANDARDS ACCEPTABLE TO PRESENT AND FUTURE INTEGRATED CIRCUIT R&D AND MANUFACTURING ORGANIZATIONS. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE RESULTANT PLAN AND SUBSEQUENT PHASE II DEVELOPMENT WILL CREATE INDUSTRY STANDARDS AND COMMERCIAL SOFTWARE COMPONENTS WHICH ELIMINATE PRESENT BARRIERS TO FULL FRAMEWORK INTEGRATION OF DIVERSE SEMICONDUCTOR TCAD TOOLS. BENEFITS INCLUDE 1) STANDARDS FOR TCAD FRAMEWORK TOOL INTERFACES, USER INTERFACES AND DATA EXCHANGE, 2) CONCURRENT TCAD USE FROM R&D THROUGH MANUFACTURING, 3) OPTIMIZATION.

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Topic#: 91-187 ID#: 9120735
Office: SSTO
Contract #: DAAH0192CR208
PI: GREGG COURAND
Title: REUSABLE KNOWLEDGE BASES
Abstract: WE PROPOSE A CONCEPTUAL FRAMEWORK AND A COLLECTION OF TOOLS TO DEVELOP A GENERAL KNOWLEDGE REPOSITORY. THIS REPOSITORY IS DESIGNED TO PROVIDE FACILITIES TO ENCODE A LARGE COLLECTION OF EXISTING AND TO-BE-DEVELOPED KNOWLEDGE BASES, AND TO SUPPORT GENERAL RETRIEVAL ACROSS THESE KNOWLEDGE BASES AS REQUIRED TO INFORM THE DEVELOPMENT OF NEW DECISION SUPPORT (OR OTHER KNOWLEDGE BASED) SYSTEMS. THE FUNDAMENTAL TECHNOLOGICAL COMMITMENTS ARE AS FOLLOWS. WE EMPLOY AN ARCHITECTURE THAT PROVIDES VERY STRONG SUPPORT FOR THE ENCAPSULATION OF KNOWLEDGE BASES AS WELL AS ANY NUMBER OF TOOLS TO OPERATE ON THOSE KNOWLEDGE BASES. WE EMPLOY A BASE REPRESENTATION LANGUAGE SUCH AS LOOM TO SERVE AS THE TARGET LANGUAGE FOR REFORMULATION OF EXISTING KNOWLEDGE BASES. WITHIN THIS BASE LANGUAGE, ALL PRIOR KNOWLEDGE WILL BE CLASSIFIED ALONG PROBLEM-SOLVING DIMENSIONS – THE GOALS, CONSTRAINTS, AND CONTEXTUAL FACTORS ASSOCIATED WITH USING THAT KNOWLEDGE TO SOLVE A GIVEN PROBLEM. WE IDENTIFY A CRITICAL KIND OF KNOWLEDGE, CALLED PROBLEM SOLVING SKILL KNOWLEDGE, WHICH DEFINES WHEN AND HOW DATA IS USED TO SOLVE PROBLEMS. THIS KNOWLEDGE IS PLAN-LIKE AND IS CRITICAL TO THE PROCESSES THAT SUPPORT KNOWLEDGE REUSE. PROBLEM-SOLVING SKILL KNOWLEDGE IS CLASSIFIED AS MENTIONED, AND INTELLIGENT BROWSING FACILITIES ARE USED TO MATCH THIS KNOWLEDGE TO USER REQUIREMENTS – THEREBY DEFINING A RETRIEVAL PARADIGM. KNOWLEDGE REPOSITORIES ARE SIGNIFICANTLY STRONGER THAN KNOWLEDGE BASES, SINCE THEY ENCODE PROBLEM-SOLVING SKILL KNOWLEDGE, NOT JUST A COLLECTION OF FACTS. THEY WILL BE USEFUL IN ALL APPLICATIONS OF KNOWLEDGE-BASED TECHNOLOGY.

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Topic#: 91-071 ID#: 9110517
Office:
Contract #: DAAH0191CR275
PI: ROBERT HOLZL
Title: RAPID PROCESSING OF MOLYBDENUM DISILICIDE COMPOSITES
Abstract: A TECHNIQUE HAS BEEN DEVISED FOR A RAPID PROCESSING TECHNIQUE FOR THE MANUFACTURE OF MOLYBDENUM DISILICIDE COMPOSITES. MOSI2 IS AN INTERESTING MATERIAL BECAUSE OF ITS DEMONSTRATED HIGH-TEMPERATURE OXIDATION RESISTANCE. UNFORTUNATELY, MONOLITHIC BODIES OF THE MATERIAL ARE NOT USEFUL BECAUSE OF ITS LOW-TEMPERATURE BRITTLENESS AND ITS INFERIOR HIGH-TEMPERATURE CREEP STRENGTH. IT IS, THEREFORE, PROPOSED TO REINFORCE THE MOSI2 WITH

HIGH-OPERATING-TEMPERATURE FIBERS. INSTEAD OF DOING THIS PROCESSING WITH CONVENTIONAL CHEMICAL VAPOR INFILTRATION, WHICH IS RATHER SLOW, ATTEMPTS WILL BE MADE TO DEMONSTRATE THE PRACTICALITY OF COMBINING CONVENTIONAL CVI WITH A SECONDARY PROCESS OF CONVERSION INFILTRATION. CONVERSION INFILTRATION MAY BE CONSIDERED ANALOGOUS TO IN SITU REACTION SINTERING OF THE MATRIX MATERIAL. EXPERIMENTS WILL BE CONDUCTED TO DETERMINE THE BETTER OF TWO ALTERNATE CONVERSION CHEMISTRIES, AND TO MAKE A PRELIMINARY DETERMINATION OF THE BEST OPERATING CONDITIONS. A SAMPLE WITH FIBER REINFORCEMENT, INTERPHASE BARRIER LAYER, INITIAL INFILTRANT, AND FINAL CONVERSION-INFILTRANT WILL BE SYNTHESIZED. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - SUCCESSFUL COMPLETION OF THE PHASE I PROGRAM WILL PROVIDE A PROCESSING PLAN WHICH WILL, IN TURN, LEAD TO THE CAPABILITY OF SYNTHESIZING PARTS FOR AIRCRAFT GAS TURBINES, AND OTHER HIGH-OPERATING TEMPERATURE DEVICES, WITH A 800 DEGREES FAHRENHEIT HIGHER OPERATING CAPABILITY THAN PRESENT-DAY SUPER ALLOYS.

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Topic#: 91-002 ID#: 9110324
Office:
Contract #: DAAH0191CR225
PI: JOSEPH CLARK

Title: INNOVATIVE APPLICATIONS OF ACOUSTIC CHARGE TRANSPORT SIGNAL MICROPROCESSOR TECHNOLOGY

Abstract: THE DEPARTMENT OF DEFENSE HAS A REQUIREMENT FOR NON-CONTACT PROXIMITY FUZING WHICH IS IMMUNE TO COUNTERMEASURES AND ELECTROMAGNETIC INTERFERENCE (EMI/EMP). DIGITAL SIGNAL CORPORATION (DCSC) HAS DEVELOPED AND DEMONSTRATED SUCH A FUZE WITH A UNIQUE DESIGN BASED ON A COHERENT SEMICONDUCTOR LASER. THE DEVICE USES OPTICS AND LASER DOPPLER INFORMATION TO PRECISELY DETERMINE THE RELATIVE VELOCITY AND DISTANCE BETWEEN THE FUZE AND A TARGET. AN ACOUSTIC CHARGE TRANSPORT (ACT) MICROPROCESSOR IS PROPOSED TO GREATLY ENHANCE THE VELOCITY RESOLUTION AND IMPROVE THE SIGNAL-TO-NOISE RATIO OF THE CURRENT PROTOTYPE FUZE. THE RESULTING LASER/ACT FUZE PACKAGE WILL BE EXTREMELY SMALL, LIGHTWEIGHT, AND INEXPENSIVE. THE PHASE I PROJECT WILL ADDRESS THE FEASIBILITY OF USING AN ACT DEVICE TO ENHANCE THE FUZE RECEIVER PERFORMANCE BY FILTERING THE DOPPLER VELOCITY INFORMATION. AN ANALYSIS WILL QUANTIFY THE EXPECTED PERFORMANCE INCREASES. SEVERAL DIFFERENT STRATEGIES FOR UTILIZING THE EXTERNAL PROGRAMMABILITY WILL BE CONSIDERED IN THE ANALYSIS. FOR EXAMPLE, PROGRAMMABILITY MAKES IT POSSIBLE TO HAVE SINGLE FUZE DESIGN FOR A WIDE VARIETY OF PLATFORMS AND MISSIONS. THE RESULTS OF THE ANALYSIS WILL BE USED TO GENERATE A PRELIMINARY DESIGN OF A PRACTICAL FUZING SYSTEM. A PROTOTYPE RECEIVER WILL BE CONSTRUCTED WITH AN ACT MICROPROCESSOR DEVICE SUPPLIED BY ELECTRONIC DECISIONS INCORPORATED (EDI). THE ACT RECEIVER, INTERFACED WITH AN EXISTING OPTICS/LASER SUBSYSTEM, WILL THEN BE MEASURED TO VALIDATE THE ANALYSIS. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE LASER/ACT FUZE DESIGN WILL BE SUITABLE FOR WIDESPREAD APPLICATION TO GRAVITY BOMBS,ANTI-ARMOR AND ANTI-AIR MISSILES. THE PRECISION OF THE POSITION AND VELOCITY SENSING WILL ENABLE THE CREATION OF A NEW CLASS OF MUNITIONS WHICH ADAPTIVELY TAILOR THEIR BLAST ENERGY.

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Topic#: 91-184 ID#: 9120464
Office: SSTO
Contract #: DAAH0192CR036
PI: FRANCESCO SCATTONE

Title: SMALL VOCABULARY TACTICAL SPEECH RECOGNIZER

Abstract: THIS IS A PROPOSAL FOR THE DEVELOPMENT OF A SYSTEM FOR CONTINUOUS SPEECH RECOGNITION OF MODERATE SIZE VOCABULARIES WITH A LOW PERPLEXITY GRAMMAR, WHICH WOULD ACHIEVE ROBUST, HIGH PERFORMANCE UNDER SEVERE OPERATIONAL CONDITIONS. THE OBJECTIVE IS TO PROVIDE ADVANCED RECOGNITION CAPABILITIES FOR TACTICAL ENVIRONMENTS, SUCH AS MILITARY

AIRCRAFT OR BATTLE MANAGEMENT, IN WHICH SPEAKERS ARE EXPOSED TO HIGH AMBIENT NOISE, AND SUBJECT TO PSYCHOLOGICAL AND PHYSICAL STRESS. THE MAIN EFFORTS IN THE DEVELOPMENT WILL CONSIST IN ELABORATING AND TESTING NEW METHODS OF HANDLING STRESS AND NOISE CONDITIONS, INTEGRATING THE IMPROVEMENTS INTO THE EXISTING HMM CONTINUOUS SPEECH RECOGNITION SYSTEM UNDER DEVELOPMENT AT DRAGON, AND DESIGNING AN ACTUAL PROTOTYPE. SPEECH RECOGNITION CAPABILITY IN REAL MILITARY ENVIRONMENTS. SPEECH INTERFACE TO COMMAND AND CONTROL BATTLE MANAGEMENT SYSTEMS. SMALL VOCABULARY VOICE DATA ENTRY APPLICATIONS IN NOISY ENVIRONMENTS.

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Topic#: 91-004 ID#: 9110097
Office:
Contract #: DAAH0191CR317
PI: J. PAN

Title: HIGH SENSITIVITY MAGNETIC SENSORS FOR REMOTE DETECTION OF GROUND VEHICLES

Abstract: IN PHASE I, E-TEK WILL ANALYZE, DESIGN AND OPTIMIZE AN INNOVATIVE PASSIVE MAGNETIC SENSORING SYSTEM TO DETECT GROUND VEHICLES. THIS INNOVATIVE MAGNETIC SENSORING SYSTEM PROVIDES <L0-13 GAUSS SENSITIVITY, GREATER THAN 4 GHZ FREQUENCY RESPONSE, LESS THAN 0.1%/DEGREE THERMAL STABILITY, EXCELLENT ABILITY TO RESIST WEATHER/ELECTRICAL, VEHICLE INTERFERENCE IMMUNITY TO LASER/MICROWAVE RADIATION. WITH E-TEK'S MANY YEARS EXPERIENCE IN DEVELOPING INTEGRATED OPTICAL DEVICES, NONLINEAR MAGNETIC-OPTIC MATERIALS, HIGH FREQUENCY MODULATORS, COMPUTER-AIDED MODELING AND SOPHISTICATED PACKAGE DESIGN, PHASE I INVESTIGATION WILL LEAD DIRECTLY AND SMOOTHLY TO PHASE II HARDWARE IMPLEMENTATION, EVALUATION AND DEMONSTRATION. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - 1) ANTENNA NEAR AND FAR FIELD MEASUREMENTS; 2) EARTHQUAKE DETECTION; 3) OIL PROSPECTING; 4) BIOMAGNETIC FIELD DETECTION; 5) ELECTRICAL INTELLIGENCE.

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Topic#: 91-062 ID#: 9110137
Office:
Contract #: DAAH0191CR168
PI: J. PAN

Title: ORGANIC NONLINEAR MATERIALS FOR WAVELENGTH CONVERSION

Abstract: IN RECENT YEARS MOLECULAR ENGINEERING HAS LED TO THE DEVELOPMENT OF ORGANIC CRYSTALS THAT POSSESS NONLINEAR OPTICAL PROPERTIES COMPARABLE TO OR EVEN BETTER THAN THOSE OF INORGANIC MATERIALS KNOWN SO FAR. THE 3-METHYL-4-METHOXY-4'-NITROSTILBENE (MMONS) IS REGARDED AS ONE OF THE MOST OUTSTANDING ORGANIC NONLINEAR OPTICAL CRYSTALS. IT HAS A CONVERSION EFFICIENCY 100 TIMES HIGHER THAN INORGANIC CRYSTAL KTP, BUT FREQUENCY DOUBLING IS ONLY SUITABLE FOR FUNDAMENTAL WAVELENGTHS LONGER THAN 1064 NM BECAUSE 532 NM IS CLOSED TO ABSORPTION EDGES. IN ORDER TO BENEFIT FREQUENCY CONVERSION (TO BLUE-GREEN) FOR LOW POWER LASER, SUCH AS SEMICONDUCTOR LASERS AND DIODE-PUMPED SOLID STATE LASER, NEW ORGANIC NONLINEAR MATERIALS WITH HIGH NONLINEARITIES, HIGH DAMAGE THRESHOLDS, MUST BE DESIGNED WITH A BETTER BLUE-SHIFT TRANSPARENCY RANGE COMPARED TO CRYSTAL MMONS. E-TEK PROPOSES TO INVESTIGATE THE SYNTHESIS OF A NEW MATERIALS, CRYSTAL GROWTH IN BULK FORM, CORED FIBER AND THIN FILM. FURTHERMORE, THEIR PROPERTIES WILL BE CHARACTERIZED AND THEIR APPLICATIONS IN OPTOELECTRONIC AREAS EXPLORED. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - NEWLY DESIGNED ORGANIC NONLINEAR MATERIALS HAVE POTENTIAL APPLICATION IN FREQUENCY CONVERSION, OPTICAL COMMUNICATION, SIGNAL PROCESSING, ETC. THEY WILL BE ESPECIALLY SUITABLE FOR DOUBLING THE OUTPUT OF LOW POWER LASERS, SUCH AS DIODE-PUMPED SOLID STATE LASERS AND SEMICONDUCTOR LASERS WITH FUNDAMENTAL WAVELENGTHS OF 0.90 ~ 1.6 UM IN ORDER TO GENERATE NEW LASER SOURCES.

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Topic#: 91-064 ID#: 9110135
Office:
Contract #: DAAH0191CR266
PI: J. PAN
Title: USING DIODE LASERS FOR COMPACT EYE-SAFE LASER RADAR
Abstract: AIRCRAFT, SHIPBOARDS AND GROUND ALL REQUIRE EYE-SAFE LASER RADAR WITH COMPACT SIZE. IN PHASE I, E-TEK WILL ANALYZE, DESIGN AND OPTIMIZE A LOW COST LASER RADAR USING CURRENTLY AVAILABLE 1.54 UM INGAASP/INP LASER DIODES AND COHERENT DETECTION RECEIVER. THE EYE-SAFE LASER RADAR DESIGN CAN BE EXPANDED TO CONSTRUCT MULTI-TARGET, LARGE FIELD-OF-VIEW, AND HIGH POWER SYSTEM FOR LONG DISTANCE APPLICATIONS, USING MONOLITHIC, PLANAR STRUCTURE. PHASE I R&D RESULTS WILL DIRECTLY LEAD TO PHASE II BREADBOARD HARDWARE FABRICATION, TEST, AND DEMONSTRATION. PRESENTLY, E-TEK HAS ALL KEY COMPONENTS REQUIRED FOR THE LASER RADAR, INCLUDING STABILIZED NARROW LINEWIDTH LASER, OPTICAL ISOLATOR, ELECTRONICALLY CONTROLLED BEAM STEERING DEVICE, TUNABLE OPTICAL FILTER, TUNABLE SEMICONDUCTOR LASER SOURCE, OPTICAL PHASE-LOCKED LOOP, POLARIZATION CONTROLLER, LD POWER SUPPLY AND STABILIZER, ETC. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - TECHNOLOGY DEVELOPED IN THIS PROJECT IS DIRECTLY APPLICABLE TO MEDICAL EQUIPMENT, TELECOMMUNICATIONS, NAVIGATION, PRECISION MEASUREMENT INSTRUMENTS, ANTICOLLISION DEVICES, OPTICAL SIGNAL PROCESSING, AUTOMATIC LANDING SYSTEM, ENVIRONMENTAL PROTECTION AND CONTROL, FIBER OPTIC SENSORS, ETC.

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Topic#: 91-241 ID#: 9120420
Office: ASTO
Contract #: DAAH0192CR035
PI: J. PAN
Title: LOW COST, LOW WEIGHT ICING DETECTOR AND ANTI-ICING DEVICES FOR UNMANNED AUTONOMOUS VEHICLES
Abstract: DARPA IS SEEKING A LOW COST, LOW WEIGHT, ICING DETECTOR AND ANTI-ICING DEVICE FOR UNMANNED AUTONOMOUS VEHICLES (UAV'S). THE CURRENT ANTI-ICING DEVICES USING ELECTRIC HEATING SUFFER FROM HIGH COST, HEAVY WEIGHT AND HIGH POWER CONSUMPTION. E-TEK PROPOSES SPECIAL CONFIGURATION OF PYRO-PIEZOELECTRIC POLYMER FILMS WHICH WORK AS BOTH ICING CONDITION DETECTOR AND ANTI-ICING DEVICE. THE NEW ICING DETECTOR AND ANTI-ICING DEVICE HAVE THE ADVANTAGES OF LOW COST, LOW WEIGHT, FLEXIBILITY, DURABILITY, ALMOST NO POWER CONSUMPTION, AND COMBUSTION RESISTANCE. THE TECHNIQUES DEVELOPED IN THIS PROGRAM CAN BE EXTENDED TO DAMPEN VIBRATION OF PRIMARY STRUCTURES AND NOISE CANCELLATION. IN ADDITION TO THEORETICAL ANALYSIS FOR THE PROPOSED ICING DETECTOR AND ANTI-ICING DEVICE, A PRACTICAL DETECTOR AND DEVICE WILL BE DESIGNED IN PHASE I. AN EXPERIMENT OF PROOF-OF-CONCEPT WILL BE PERFORMED IN PHASE I PROGRAM ALSO. ANTI-ICING IN COMMERCIAL AIRCRAFT NOISE ISOLATION DAMPING OF VIBRATIONS IN BRIDGE AND BUILDING STRUCTURES

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Topic#: 91-101 ID#: 9120120
Office: DSO
Contract #: DAAH0192CR033
PI: K. ABRAHAM
Title: NOVEL SOLID ELECTROLYTES FOR LITHIUM BATTERIES
Abstract: NOVEL CONCEPTS ARE PROPOSED TO PREPARE LI+-CONDUCTIVE SOLID POLYMER ELECTROLYTES WITH IONIC CONDUCTIVITIES OF THE ORDER OF 10-3 TO 10-2 OHM-L.CM-1 AT ROOM TEMPERATURE AND BELOW. HIGH IONIC CONDUCTIVITY IN THESE ELECTROLYTES IS EXPECTED TO RESULT FROM THE USE OF ELECTROLYTE COMPONENTS WHICH ENHANCE THE MOBILITY AND CONCENTRATION OF THE IONIC CHARGE CARRIERS. THE SYNTHESIZED ELECTROLYTES WILL BE CHARACTERIZED BY MEASURING THEIR CONDUCTIVITY IN THE -340C TO 250C RANGE AND EVALUATING THEIR PERFORMANCE IN LI/MNO2 SOLID-STATE CELLS. NEW SOLID ELECTROLYTES IDENTIFIED IN THIS RESEARCH CAN LEAD TO THE

DEVELOPMENT OF SOLID-STATE LI BATTERIES WITH HIGH-RATE DISCHARGE CAPABILITY AT AMBIENT TEMPERATURES. COMMERCIAL APPLICATIONS OF SOLID-STATE RECHARGEABLE LI BATTERIES INCLUDE PORTABLE RADIOS, COMPUTERS, CAMCORDERS, HANDHELD TOOLS AND, ULTIMATELY, ELECTRIC VEHICLES.

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Topic#: 91-022 ID#: 9110515
Office:
Contract #: DAAH0191CR307
PI: ROBERT LARSON

Title: COMPUTER ANALYSIS OF NEW MICROWAVE DEVICES AND/OR MONOLITHIC CIRCUIT TECHNIQUES

Abstract: THIS PROPOSAL SUGGESTS A NEW METHODOLOGY, MADE PRACTICAL BY NEW HARDWARE, TO EFFICIENTLY OBTAIN OPTIMUM DESIGN PARAMETERS FOR MILLIMETER WAVE CIRCUITS. THE TECHNIQUE IS BASED ON THE TIME DOMAIN FINITE DIFFERENCE (TDFD) APPROACH TO THE TIME ADVANCING OF MAXWELL'S EQUATIONS. THE SCATTERING MATRIX AND OTHER PARAMETERS CAN BE READILY DETERMINED OVER THE DESIRED FREQUENCY DESIGN RANGE. THE METHOD'S ADVANTAGES ARE PRIMARILY IN THE AREAS OF LARGE AND COMPLICATED CIRCUITS, WHICH CAN BE ANALYZED MORE RAPIDLY THAN WITH ANY OTHER METHOD. THE ADVANTAGES LIE IN BEING ABLE TO ANALYZE LARGE PROBLEMS MORE RAPIDLY. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - COMPLICATED MILLIMETER WAVE CIRCUITRY PRESENTLY OFTEN REQUIRES A LENGTHY ITERATIVE APPROACH INCLUDING EXTENSIVE EXPERIMENTATION. THE ITERATIVE PROCEDURE IS BECAUSE INTERACTION OF SCATTERING OBJECTS IN NEW AND COMPLEX GEOMETRIES CANNOT BE READILY HANDLED BY EXISTING DESIGN TOOLS. THE PROPOSED APPROACH WILL BE MADE AVAILABLE TO THE DESIGNERS OF SUCH CIRCUITS FOR PURPOSES OF GREATLY IMPROVING THE ACCURACY OF THE FIRST DESIGN AND FOR ANALYZING EXPERIMENTAL TIME-DOMAIN RESULTS.

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Topic#: 91-156 ID#: 9121116
Office: ESTO
Contract #: DAAH0192CR123
PI: RONAL LARSON

Title: COMPUTER AIDED DESIGN AND PROCESS MODELS FOR MICROWAVE AND MILLIMETER WAVE DEVICES AND CIRCUITS

Abstract: THE TIME DOMAIN FINITE DIFFERENCE (TDFD) METHOD OF SOLVING ELECTROMAGNETIC FIELD PROBLEMS IS A RELATIVELY NEW METHODOLOGY WITH A PROVEN CAPABILITY FOR ACCURATELY ANALYZING PASSIVE MIC/MMIC STRUCTURES. THE TECHNIQUE SUPPLIES COMPLETE SCATTERING MATRICES IN EITHER THE TIME OR FREQUENCY DOMAIN. MILLIONS OF FIELD POINTS CAN BE ANALYZED IN PROBLEM "CUBES" WELL OVER 100 CELLS ON A SIDE. WITH SPECIAL PURPOSE PIPELINED HARDWARE DEVELOPED ON A U.S. ARMY PHASE II SBIR, FULL PROBLEM SOLUTIONS CAN BE CARRIED OUT IN MINUTES, THE PROPOSERS WILL SOON BEGIN A DARPA SBIR TO TIE THIS NEW METHODOLOGY IN WITH EXISTING CAD AND CAE SOFTWARE EFFORTS. THE PROPOSERS ARE UNAWARE OF ANY SIMILAR RECENTLY PUBLISHED LITERATURE ON TDFD METHODOLOGY AND ACTIVE MIC AND MMIC DEVICES. HOWEVER, THE PROPOSERS HAVE WORKED IN A VERY SIMILAR AREA: THE TDFD ANALYSIS OF THE LIGHTNING LEADER. THIS IS A NONLINEAR PROBLEM REQUIRING A FULL ACCOUNTING OF ELECTRONS AND POSITIVE NEGATIVE IONS. THIS HAS A FULL ANALOGY WITH THE ANALYSIS OF ACTIVE SOLID STATE DEVICES SINCE BOTH RELATE PARTICLE VELOCITIES TO THE ELECTRIC FIELDS THROUGH MOBILITIES. WE CAN ANALYZE IN BOTH A LINEAR AND NONLINEAR MODE; THE LATTER TYPICALLY INCREASES THE ANALYSIS TIME BY AN ORDER OF MAGNITUDE. ALL OF THE CHARACTERISTICS CLAIMED FOR PASSIVE DEVICES SHOULD ALSO HOLD FOR ACTIVE DEVICE ANALYSIS: GOOD ACCURACY, FULL AND DETAILED MODELING OF THE GEOMETRY, AND RAPID ANALYSIS IN EITHER THE TIME OR FREQUENCY DOMAINS. THE BENEFITS WILL ARISE FROM MORE ACCURATELY PREDICTING THE DEVICE BEHAVIOR PRIOR TO FABRICATION. THE COMMERCIAL APPLICATION IS IN MARKETING THIS SOFTWARE, WITH A POSSIBLE HARDWARE OPTION.

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Phone: (213) 534-3666
Topic#: 91-060 ID#: 9110732
Office:
Contract #: DAAH0191CR302
PI: M. YANG
Title: SILICON-BASED HIGH-DENSITY LWIR IMAGING ARRAYS
Abstract: WE PROPOSE A NEW APPROACH TO LONG WAVELENGTH INFRARED (LWIR) IMAGING ARRAYS USING SUPERLATTICE SCHOTTKY BARRIER (SB) PHOTODIODES GROWN BY MOLECULAR BEAM EPITAXY (MBE) ON SILICON (SI). THE SUPERLATTICE SB PHOTODIODES ARE PROCESSED WITH READOUT ELECTRONICS ON THE SI FORMING A MONOLITHIC ARRAY. WE WILL FIRST PERFORM THE MBE GROWTH OF THE COBALT SILICIDE/SI SUPERLATTICE TO DEMONSTRATE THE FEASIBILITY OF FABRICATING THE SUPERLATTICE SB PHOTODIODES FOR A 12-MICRON WAVELENGTH CUTOFF, FOLLOWED BY DESIGNING AN APPROPRIATE READOUT SCHEME FOR THE PHOTODIODES TO FORM A MONOLITHIC ARRAY. OUR OVERALL GOAL IS TO DEVELOP THE SB ARRAY WITH HIGH DENSITY, AND OPTIMIZE IT FOR A 40% QUANTUM EFFICIENCY, A 1% NON-UNIFORMITY AND A FABRICATION COST COMPARABLE TO THAT OF THE CURRENTLY-AVAILABLE PT-SILICIDE SB ARRAY COVERING THE 3-5 MICRON SPECTRAL BAND. THE RESULTANT LWIR ARRAYS WILL FIND APPLICATIONS IN FLIRS, SPACE-BASED INTERCEPTORS AND EARLY WARNING AND SURVEILLANCE SYSTEMS. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS- INFRARED SURVEILLANCE SYSTEMS, SEEKERS, FLIRS AND SMART MUNITION SYSTEMS, AND IN COMMERCIAL SYSTEMS SUCH AS REMOTE SENSING OF EARTH RESOURCES, ASTRONOMY, MEDICAL IMAGING SYSTEMS AND THERMAL IMAGING SYSTEMS FOR PROCESS CONTROL.

ELECTRO-OPTEK CORP.
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Phone: (213) 534-3666
Topic#: 91-175 ID#: 9120553
Office: MTO
Contract #: DAAH0192CR184
PI: M. LEE
Title: SILICON BASED UNCOOLED HIGH PERFORMANCE LWIR ARRAYS
Abstract: ELECTRO-OPTEK PROPOSES TO DEVELOP A NOVEL AND INNOVATIVE METHOD OF FABRICATING LARGE-AREA LONG WAVELENGTH INFRARED (LWIR) DETECTOR ARRAYS THAT CAN OPERATE AT ROOM TEMPERATURE. THIS TECHNIQUE USES ESTABLISHED TECHNOLOGIES OF MICRO-MACHINING AND MICROELECTRONIC PROCESSING OF SILICON (SI) WAFERS FOR FABRICATING MONOLITHIC ARRAYS OF LWIR DETECTORS. THE DETECTOR ELEMENTS OF THE ARRAY ARE FORMED BY AN ULTRA-THIN FILM OF A BOLOMETER MATERIAL POSSESSING THE HIGHEST TEMPERATURE COEFFICIENT OF RESISTANCE KNOWN, AND THE READOUT ELECTRONIC MICROCIRCUIT IS FABRICATED ON THE SAME SILICON CHIP NEXT TO THE ELEMENTS. THE RESULTANT DETECTOR ARRAYS WILL POSSESS FEATURES OF LOW COST, LOW WEIGHT, HIGH RESPONSIVITY AND HIGH SENSITIVITY. THE LOW COST IS DUE TO A SINGLE BATCH PROCESS IN THE ARRAY FABRICATION. THE LOW WEIGHT IS DUE TO A MONOLITHIC ARRAY STRUCTURE REQUIRING NO COOLING. THE HIGH RESPONSIVITY IS DUE A LARGE TEMPERATURE COEFFICIENT OF RESISTIVITY (>15% COMPARED TO 0.2% FOR A CONVENTIONAL BOLOMETER) OF OUR NEW BOLOMETER MATERIAL. THE HIGH SENSITIVITY IS DUE TO THE COMBINED EFFECTS OF HIGH RESPONSIVITY, LOW NOISE AND HIGH THERMAL ISOLATION OF THE BOLOMETER FROM ITS SURROUNDINGS.

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Phone: (213) 534-3666
Topic#: 91-176 ID#: 9120558
Office: MTO
Contract #: DAAH0192CR155
PI: C. HUANG
Title: MULTISPECTRAL INFRARED IMAGING ARRAY USING ALGAAS/GAAS MULTIPLE QUANTUM WELLS
Abstract: WE PROPOSE TO DEVELOP A MULTISPECTRAL INFRARED (IR) IMAGING SYSTEM USING ALGAAS/GAAS MULTIPLE QUANTUM WELLS (MQW) FOCAL PLANE ARRAYS (FPAS) FOR DETECTING RADIATION IN MULTIPLE SPECTRAL BANDS. THE DETECTOR STRUCTURE COMPRISES A VERTICAL STACK OF TWO (OR MORE) DIFFERENT PERIODICITY OF MQWS: ONE CORRESPONDS TO LONG-WAVELENGTH (LWIR, 8-12 MICRON) AND THE OTHER CORRESPONDS TO MEDIUM-WAVELENGTH (MWIR, 3-5 MICRON) FORMING A

TWO-COLOR (OR MULTI-COLOR) IMAGING ARRAY. THE RESULTANT MULTISPECTRAL IR IMAGING ARRAY IS CAPABLE OF MEASURING SIMULTANEOUSLY SPATIAL AS WELL AS SPECTRAL DISTRIBUTIONS OF IR TARGETS FOR TARGET RECOGNITION AND DISCRIMINATION AGAINST CLUTTER OR DECOYS. A PLASMA-ASSISTED METALORGANIC MOLECULAR BEAM EPITAXY (PAMOMBE) PROCESS WILL BE USED TO GROW MQW STRUCTURES. IN PHASE I, WE WILL DESIGN ULTRA-HIGH VACUUM FIXTURES FOR EPITAXY TO ACHIEVE A HIGH GROWTH RATE UNDER AN ULTRA-PURE MBE GROWTH ENVIRONMENT AND DELINEATE THE PAMOMBE PROCESSES TO GROW THE MQW DEVICES. WE WILL ALSO EVALUATE THE SYSTEM PERFORMANCE OF MULTISPECTRAL IR IMAGER WITH THE FPAS AND READOUT ELECTRONICS. IN SUBSEQUENT PHASES, WE WILL FABRICATE SEVERAL MQWS ONE ON TOP OF ANOTHER FORMING A VERTICAL STACK OF IR DETECTORS. THESE STACKS WILL THEN BE FABRICATED INTO A 2-DIMENSIONAL ARRAY FORM FOR MULTISPECTRAL IMAGING AND WILL BE MONOLITHICALLY INTEGRATED TO THE MULTIPLEXER AND READOUT ELECTRONICS. IR SPECTROSCOPY, IR DETECTOR ARRAYS, THERMAL IMAGING, IR SURVEILLANCE, IMAGING, SMART MUNITIONS THAT ARE LIGHT WEIGHT AND HIGH PERFORMANCE.

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Topic#: 91-242 ID#: 9120613
Office: ASTO
Contract #: DAAH0192CR130
PI: E. DINES

Title: SURFACE EMITTING LASER ARRAY FOR UAV AUTOMATIC LANDING

Abstract: WE PROPOSE TO DEVELOP A LOW-COST TECHNIQUE FOR UAV AUTOMATIC LANDING, USING A HIGH-DENSITY ARRAY OF SURFACE EMITTING LASERS (SEL) FOR ACTIVE IMAGING OF RUNWAY AND ACTIVE COMPUTING OF RANGE. WE WILL DEVELOP THE SEL ARRAY USING INGAAS/GAAS MULTIPLE QUANTUM WELLS (MQWS) SANDWICHED BETWEEN TWO DISTRIBUTED BRAGG REFLECTORS (DBR) OF GAAS/ALAS. THE MQWS AND DBR WILL BE FABRICATED ON GAAS SUBSTRATE IN TANDEM BY MOLECULAR BEAM EPITAXY (MBE). THE TWO-DIMENSIONAL ARRAY OF THE MQW LASERS WILL LASE PERPENDICULAR TO THE SURFACE OF THE SUBSTRATE AND THE EMITTED POWER FROM EACH LASER CAN BE CONTROLLED INDEPENDENTLY AND COHERENTLY. IN ADDITION, WE WILL DEVELOP A PHOTODETECTOR PLACED NEXT TO EACH LASER PIXEL, RESULTING IN A 2-DIMENSIONAL ARRAY OF RADAR ELEMENTS, WHICH WILL TAKE IMAGES OF THE RUNWAY AHEAD TOGETHER WITH RANGE MEASUREMENTS. THE MAJOR PHASE I TASK IS TO CONCEIVE AND DESIGN THE ARRAY LAYOUT, THE ON-CHIP BIAS/ADDRESS CIRCUIT AND THE CONTROL PROCESSOR NEEDED FOR THE ARRAY OPERATION AND IMAGE GENERATION AND RANGE COMPUTATION. THIS IS FOLLOWED BY A DELINEATION OF AN MBE PROCESS TO FABRICATE THE MULTIPLE LAYERS FOR THE SEL AND DETECTORS ALL ON A SINGLE GAAS WAFER. THE RESULTANT SEL RADAR ARRAY WILL BE USED FOR GENERATING MODULATED IMAGES WITH HIGH RESOLUTION AND HIGH DYNAMIC RANGE, WITH CORRESPONDING RANGE VALUES, THUS MAKING IT IDEAL FOR AUTOMATIC LANDING SYSTEMS FOR UAVS AND LANDING AID SYSTEMS FOR MANNED AIRCRAFT. AUTOMATIC LANDING SYSTEMS FOR ALL AIRCRAFT, AUTONOMOUS NAVIGATION SYSTEMS, OPTICAL COMPUTING, OPTICAL SIGNAL PROCESSING, NEURAL NETWORKING AND INFRARED SCENE GENERATION.

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Topic#: 91-008 ID#: 9110528
Office:
Contract #: DAAH0191CR238
PI: VINOD JALAN

Title: HIGH POWER, HIGH ENERGY DENSITY ELECTRIC STORAGE DEVICE

Abstract: THE HIGH ENERGY DENSITY, HIGH RATE CAPABILITY SYSTEM PROPOSED TO PROVIDE PULSE-POWER FOR ELECTRIC WEAPONS EMPLOYS VERY HIGH SURFACE AREA ELECTRODES AND A SOLID ELECTROLYTE WITH HIGH CONDUCTIVITY AND A HIGH DECOMPOSITION POTENTIAL. THE SYSTEM WILL BE PRIMARILY EVALUATED AS A CAPACITOR, BUT WITH MINOR MODIFICATIONS WILL ALSO BE TESTED AS A RECHARGEABLE BATTERY. THE DEVICE DESCRIBED HERE WILL PROVIDE AN ORDER OF MAGNITUDE HIGHER ENERGY DENSITY THAN COMMERCIALLY AVAILABLE DOUBLE LAYER CAPACITORS AND IS OVER

THREE TIMES HIGHER THAN THE ENERGY DENSITY OBJECTIVE SPECIFIED IN THE PROPOSAL. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE SUCCESSFUL COMPLETION OF THIS RESEARCH PROJECT WILL PROVIDE AN ADVANCED CAPACITOR WITH HIGHER ENERGY DENSITY THAN ANY COMMERCIALLY AVAILABLE. THIS DEVICE WILL ALSO FULFILL MANY RECHARGEABLE BATTERY APPLICATIONS THAT REQUIRED MORE COULOMBIC CAPACITY THAN A CAPACITOR HERETOPORE COULD OFFER. SINCE THIS DEVICE WILL CYCLE WITHOUT CHANGES IN THE MORPHOLOGY OF THE ACTIVE COMPONENTS, IT WILL DELIVER MANY MORE RECHARGING CYCLES THAN ANY BATTERY SYSTEM.

ELECTRONIC CONCEPTS & ENGINEERING
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Topic#: 91-231 ID#: 9120181
Office: MICOM
Contract #: DAAH0192CR179
PI: WILLIAM SWONGER
Title: ULTRA LOW COST ENGINE CONTROL SYSTEM
Abstract: PRESENT TURBOJET ENGINE CONTROL SYSTEMS, WHICH ARE COMPRISED OF: CONTROLLER, FUEL METERING DEVICE, SENSORS, CONNECTORS, AND HARNESSES ARE THE SINGLE MOST EXPENSIVE SUBSYSTEM ON EXPENDABLE TURBOJET ENGINES. THE SIZE AND COST OF EXPENDABLE TURBOJET ENGINES HAS STEADILY DECREASED. HOWEVER, THE ENGINE CONTROL SYSTEM COST HAS REMAINED RELATIVELY CONSTANT. ELECTRONIC CONCEPTS PROPOSES TO DEMONSTRATE THAT SIGNIFICANT COST REDUCTIONS CAN BE REALIZED IN EXPENDABLE TURBOJET ENGINE CONTROL SYSTEMS BY: 1) APPLYING HIGHLY INTEGRATED CIRCUIT TECHNOLOGY, 2) UTILIZING A DERIVATIVE OF AUTOMOTIVE FUEL METERING TECHNOLOGY, AND 3) BY INTEGRATING THE CONTROL ELECTRONICS, ENGINE SENSORS AND FUEL METERING DEVICES INTO A SINGLE ENCLOSURE THUS ELIMINATING EXPENSIVE HARNESS AND ELECTRICAL CONNECTORS. SUCCESSFUL COMPLETION OF THIS PHASE I EFFORT WILL LAY A FOUNDATION FOR A PHASE II FLIGHTWEIGHT ULTRA LOW COST ENGINE CONTROL SYSTEM. AN ULTRA LOW COST ENGINE CONTROL SYSTEM AND ASSOCIATED TECHNOLOGY CAN BE DIRECTLY APPLIED TO COMMERCIAL AND MILITARY TURBINE ENGINE POWERED GROUND START CARTS, POWER GENERATING UNITS, AND AIR CONDITIONING CARTS. IN ADDITION, A MAJORITY OF AIRCRAFT AUXILIARY POWER UNITS (APU'S) ARE POWERED BY SMALL TURBINE ENGINES WHICH REPRESENT AN IDEAL APPLICATION FOR ULTRA LOW COST ENGINE CONTROL SYSTEMS.

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Topic#: 91-074 ID#: 9110369
Office:
Contract #: DAAH0191CR191
PI: JOHN WHITE
Title: ADVANCED PEROVSKITE ELECTROCATALYSIS FOR DIRECT METHANOL FUEL CELLS
Abstract: THE PROPOSED PHASE I PROGRAM ADDRESSES PROBLEMS CURRENTLY INHIBITING DEVELOPMENT OF DIRECT METHANOL FUEL CELLS BY SUBSTITUTING HIGH AREA PEROVSKITE ELECTROCATALYSTS OF THE GENERAL COMPOSITION LN1-XAXCOO3, AND ACO1-XFEXO3 (WHERE LN - LA, ND, SM AND EU; A' = BA, SR, CA AND CE WITH O < X < 0.6; A - BA AND SR WITH O < X < O.4) FOR DISPERSED NOBLE METAL ELECTOCATALYSTS CURRENTLY USED FOR THIS APPLICATION IN SOLID POLYMER ELECTROLYTE (PE) BASED FUEL CELLS. THE ABILITY OF THE PROPOSED ANODE ELECTROCATALYSTS TO MAINTAIN HIGHER LONG TERM ACTIVITY THAN CURRENT NOBLE METAL ELECTROCATALYSTS WILL IN-PART BE RELATED TO THEIR CAPACITY TOWARDS SUPPLYING BASIC SURFACE OXIDE IONS FOR DEHYDROGENATION OF ADSORBED METHANOL AND FOR SUBSEQUENT OXIDATIVE REACTION TOWARDS CHEMISORBED INTERMEDIATES WHICH MIGHT POTENTIALLY POISON ELECTRO-CATALYST REACTION SITES. WE EXPECT THAT TRANSITION METAL D-ORBITAL OCCUPANCY WILL ALSO INFLUENCE PEROVSKITE ELECTROCATALYST ACTIVITY TOWARDS THE OXIDATIVE REMOVAL OF INTERMEDIATES. WORK TO BE PERFORMED DURING PHASE I WILL CHARACTERIZE THE ELECTROCHEMICAL UTILITY OF PROPOSED PEROVSKITE ELECTROCATALYSTS. THESE MATERIALS WILL BE INCORPORATED INTO GAS DIFFUSION ANODES WITHIN PE FUEL CELLS. WE ANTICIPATE THAT SUCH A STRATEGY WILL PROVIDE A DIRECT METHANOL FUEL CELL WITH ANODE ELECTROCATALYST SITES FREE OF SURFACE POISONING RESTRICTIONS CURRENTLY

INHERENT WITH PLATINUM ALLOY BASED ELECTROCATALYSTS. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE ANTICIPATED BENEFIT TO RESULT FROM PERFORMANCE OF THIS PROGRAM WILL BE THE IDENTIFICATION OF ADVANCED PEROVSKITE ELECTROCATALYSIS AND GAS DIFFUSION ELECTRODE TECHNOLOGY COMPATIBLE FOR INCORPORATION INTO DIRECT METHANOL POLYMER ELECTROLYTE FUEL CELLS. SINCE THE PROPOSED ELECTROCATALYSTS ARE EXPECTED TO BE INSENSITIVE TO SURFACE POISONING EFFECTS CAUSED BY METHANOL PARTIAL OXIDATION PRODUCTS, LONG PERFORMANCE LIFETIMES CAN BE EXPECTED.

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Topic#: 91-184 ID#: 9120471
Office: SSTO
Contract #: DAAH0192CR034
PI: S. HUTCHINS
Title: NOISE ADAPTIVE TECHNIQUES FOR TACTICAL SPEECH RECOGNIZERS
Abstract: THE PURPOSE OF THIS RESEARCH EFFORT IS TO DEVELOP A PROTOTYPE TACTICAL SPEECH RECOGNIZER BY MODIFYING AND EXTENDING EMERSON & STERN'S CURRENT TECHNOLOGIES FOR SPEAKER-INDEPENDENT (I.E. NO TRAINING), CONTINUOUS SPEECH RECOGNITION, INCLUDING ITS EXISTING STRESS RESISTANCE, NOISE-TRACKING AND NOISE-RESISTANCE ALGORITHMS. EMERSON & STERN RECENTLY INTRODUCED SOLILOQUY(TM) VOICE INTERFACE SOFTWARE, WHICH OFFERS SPEAKER-INDEPENDENT, SMALL VOCABULARY, CONTINUOUS SPEECH RECOGNITION ON A MACINTOSH IICI FOR MODERATELY NOISY ENVIRONMENTS, SUCH AS A TRADE SHOW FLOOR. SPECIFIC OBJECTIVES AND METHODS OF THIS RESEARCH INCLUDE (1) ESTABLISHING A PERFORMANCE BASELINE FOR CURRENT NOISE RESISTANCE AGAINST TYPICAL NOISE CONDITIONS FROM JEEPS, PLANES, TANKS, AND HELICOPTERS; (2) IMPLEMENTING AND EVALUATING ENHANCEMENTS THAT WILL TAKE ADVANTAGE OF PUSH-TO-TALK SCENARIOS IN WHICH NOISE LEVELS COULD BE CONTINUOUSLY MONITORED PRIOR TO INITIATION OF RECOGNITION; (3) IMPLEMENTING AND EVALUATING TRADITIONAL NOISE CANCELING TECHNIQUES; (4) IMPLEMENTING AND EVALUATING THE EXTREME THEORY OF VOICE COMPRESSIONS; AND (5) MODELING ENVIRONMENTALLY SPECIFIC BURST NOISE EVENTS SO THEY CAN BE IGNORED AND TESTING THE RESULTS. IF THE PHASE I EFFORT IS SUCCESSFUL, IT WILL BE POSSIBLE IN PHASE II TO REFINE AND EXTEND THESE ALGORITHMS TO COVER OTHER CONDITIONS, TEST THEM IN A REALISTIC ENVIRONMENT, AND DEVELOP AN APPROPRIATE HARDWARE/SOFTWARE IMPLEMENTATION FOR INTEGRATION INTO EQUIPMENT. THE ADDITION OF NOISE ROBUSTNESS AND STRESS-RESISTANCE TO SOLILOQUY TECHNOLOGY WILL SIGNIFICANTLY INCREASE ITS APPLICABILITY IN TACTICAL & COMMERCIAL ENVIRONMENTS WHERE SIMILAR ACOUSTIC CONDITIONS OCCUR. EXAMPLES INCLUDE BOTH COMMERCIAL AND MILITARY COCKPITS, FLIGHT LINE MAINTENANCE, INTRAVEHICLE COMMUNICATION--WHETHER MILITARY JEEPS AND TANKS OR COMMERCIAL TRUCKS WITH GLOBAL POSITIONING SYSTEMS, OR EVEN MAIL ROOMS AND FACTORIES. THIS SOLUTION COULD ALSO BE EXTENDED TO RADIO-BASED COMMUNICATIONS, WHETHER ON THE BATTLEFIELD OR ON A LOADING DOCK.

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Topic#: 91-117 ID#: 9120713
Office: DSO
Contract #: DAAH0192CR090
PI: IAIN MCINTYRE
Title: SELF Q-SWITCHED MICROLASERS
Abstract: MICROLASERS FORM A NEW CLASS OF MINIATURIZED LASER WHICH ARE CAPABLE OF PRODUCING PULSES IN THE MW REGIME WITH SUBNANOSECOND DURATION, SUITABLE FOR NONLINEAR PROCESSING SUCH AS PARAMETRIC WAVELENGTH CONVERSION. THE MAJOR DIFFICULTIES WITH MICROLASERS LIE IN A) THE LASER MATERIAL WHICH SHOULD IDEALLY ABSORB 100% OF THE PUMP LIGHT WITHIN A SHORT DISTANCE AND B) THE ABILITY TO Q-SWITCH SINCE THE LASER CAVITY IS EXTREMELY SHORT AND LACKS THE SPACE FOR CONVENTIONAL COMPONENTS USING Q-SWITCHING. A PROGRAM OF RESEARCH IS PROPOSED TO SEARCH FOR THE OPTIMUM LASER MATERIAL WHICH CAN COMBINE HIGH. EFFICIENCY WITH THE CORRECT ELECTRO-OPTIC PROPERTIES. TECHNIQUES ARE PROPOSED WHICH WILL ALLOW THE

Q-SWITCHED MICROLASER TO BE MANUFACTURED SIMPLY, USING ONLY COATING TECHNIQUES; THE Q-SWITCHING IS NOT PERFORMED USING EXTERNAL COMPONENTS AS HAS BEEN PROPOSED ELSEWHERE, SINCE THIS ADDS TO THE COMPLEXITY AND ULTIMATELY DETRACTS FROM THE ABILITY OF THE MICROLASER TO BE MASS PRODUCED AND DEPLOYED IN ARRAYS. THE BEHAVIOR OF THE PROPOSED MICROLASER WILL BE MODELED BEFORE VERIFICATION IN A PHASE II PROGRAM WHICH WILL DEMONSTRATE SCALING TO ARRAYS AND PHASING OF THE LASER OUTPUTS. THE LASER DEVELOPED IN THIS PROGRAM WILL BE ABLE TO PRODUCE SUBNANOSECOND PULSES WITH MW PEAK POWERS. THUS, OVER AND ABOVE THE ARRAYING OF THE LASER AND ITS USE IN COMMUNICATION, AND ALSO RANGING, THE LASER WILL BE ABLE TO SERVE AS A MINIATURE SOURCE IN LIDAR ARID WILL ALSO HAVE APPLICATION IN PHOTOCONDUCTIVE SWITCHING FOR HPM, ULTRA WIDEBAND RADAR AND HIGH POWER ELECTRICAL SWITCHING.

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Topic#: 91-193 ID#: 9121072
Office: CSTO
Contract #: DAAH0192CR122
PI: DAVID LOWRY
Title: THIRD GENERATION SWITCHED MULTI-MEGABIT DATA SERVICE INTERFACE PROPOSAL
Abstract: THE SWITCHED MULTI-MEGABIT DATA SERVICE (SMDS) PROPOSED BY AMERICAN TELEPHONE & TELEGRAPH (AT&T) IS A SYSTEM FOR THE ECONOMICAL COMMUNICATION OF LARGE AMOUNTS OF INFORMATION WITH THE SAME INTERCONNECT TOPOLOGY AS THE VOICE PHONE NETWORK. THIS SYSTEM WILL BE A CATALYST TECHNOLOGY TO BASIC RESEARCH IN THE UNITED STATES. ENGINEERING DESIGN TEAM, INC. (EDT) INTENDS TO DEVELOP A LOW-COST SMDS INTERCONNECT TECHNOLOGY UTILIZING A HIGHLY-INTEGRATED SINGLE BOARD INTERFACE WHICH CONNECTS DIRECTLY TO THE PHONE SERVICE AND ELIMINATES THE NEED FOR ADDITIONAL EQUIPMENT. THIS BOARD WILL BE INSTALLED IN A STANDARD COMMERCIAL COMPUTER WHICH PROVIDES THE NETWORK INTERCONNECT SERVICE. THE PROPOSED SYSTEM WILL FUNCTION AT THE DSI AND DS3 LEVELS. DEVELOPMENT AND IMPLEMENTATION OF THIS LOW COST SMDS INTERFACE WILL ALLOW TRANSFER AND SHARING OF INFORMATION BETWEEN FACILITIES QUICKLY AND EFFICIENTLY, AND WILL RESULT IN DRAMATICALLY LOWER CONNECTION COSTS, MORE USERS AND LOWER CONNECTION TARIFFS.

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Topic#: 91-017 ID#: 9110329
Office:
Contract #: DAAH0191CR248
PI: DOUGLAS BAUMGARDT
Title: SEISMIC DISCRIMINANTS IN EURASIA
Abstract: THIS PROPOSED PHASE I RESEARCH PROJECT PROVIDES A UNIQUE OPPORTUNITY TO REVIEW REGIONAL SEISMIC DISCRIMINANTS, DEVELOP A STATISTICAL METHOD FOR IDENTIFYING EVENTS, DEVELOP QUALITY CONTROL PROCEDURES FOR ALLOWING FOR EFFECTS OF NOISE AND REGIONAL PROPAGATION EFFECTS ON DISCRIMINANTS, AND TO STATISTICALLY ANALYZE THE DISCRIMINATION CAPABILITY OF THESE REGIONAL DISCRIMINANTS. THE LARGE DATABASE OF REGIONAL WAVEFORMS AND SPECTRA PRODUCED BY THE INTELLIGENT MONITORING SYSTEM (IMS), IMPLEMENTED AT THE CENTER FOR SEISMIC STUDIES (CSS), WILL BE USED TO TEST THE DISCRIMINATION METHODS. SPECTRAL RMS LEVELS FOR EACH REGIONAL PHASE WILL BE DETERMINED FOR MANY EARTHQUAKES AND ECONOMIC EXPLOSIONS IN EURASIA AND INPUT TO THE DISCRIMINATION APPROACH. A MULTIVARIATE, MAXIMUM-LIKELIHOOD APPROACH WILL BE USED TO ESTIMATE DISCRIMINANT FUNCTIONS FOR DISTINGUISHING EXPLOSIONS AND EARTHQUAKES. THE METHOD WILL SYSTEMATICALLY ACCOUNT FOR DATA CENSORING WHEN SIGNAL LEVELS ARE LESS THAN THE NOISE. THE STATISTICAL INTERDEPENDENCE OF THE DISCRIMINANTS WILL ALSO BE EXAMINED. THE EFFECT ON THE DISCRIMINANTS OF POTENTIAL EVASION SCENARIOS, INCLUDING DECOUPLING, ARRAY SHOT, AND HIDE-IN-EARTHQUAKE, WILL BE INVESTIGATED. THE RESULTANT TECHNIQUES WILL BE INCLUDED IN THE INTELLIGENT SEISMIC EVENT SYSTEM (ISEIS) CURRENTLY BEING DEVELOPED FOR ROUTINE EVENT IDENTIFICATION IN THE IMS. ANTICIPATED BENEFITS - THE RESULTS

OF THIS STUDY WILL PROVIDE A BETTER UNDERSTANDING OF REGIONAL DISCRIMINANTS ON A STATISTICAL BASIS. THE ANALYSIS OF THE LARGE IMS DATABASE, COLLECTED FROM THE NEW REGIONAL ARRAYS AND SINGLE SEISMIC STATIONS LOCATED IN EURASIA, WILL PROVIDE AN EVALUATION OF THE CAPABILITIES OF THE NEW SEISMIC DATA SOURCES FOR EVENT IDENTIFICATION. THE RESULTS OF THIS RESEARCH WILL BE DIRECTLY INCORPORATED IN THE ISEIS SYSTEM AT THE CSS.

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Topic#: 91-086
Office: NMRO
Contract #: DAAH0192CR050
PI: ZOLTAN DER
ID#: 9120794
Title: AUTOMATED SEISMIC ANALYSIS USING SUPERVISED MACHINE LEARNING
Abstract: THE SBIR PHASE I PROJECT PROPOSED CONSISTS OF THE TESTING OF THE CLASSIFICATION PERFORMANCE OF SEVERAL RELATED MACHINE LEARNING METHODS TO SEISMIC DISCRIMINATION. SEVERAL OTHER APPLICATIONS OF THESE METHODS ARE ALSO SUGGESTED. IN THE APPLICATION TO DISCRIMINATION, THE FOLLOWING DATA SETS WILL BE USED: REGIONAL ARRAY DATA FOR EARTH-QUAKES AND QUARRY BLASTS IN THE SCANDINAVIAN REGIONS, IRIS DATA RECORDED IN THE USSR AND SELECTED DATA SETS USED PREVIOUSLY TO DEDUCE DISCRIMINANTS. THE PERFORMANCE OF THESE TECHNIQUES WILL BE EVALUATED BY VARIOUS DATA PARTITIONING AND RESAMPLING METHODS. THE OBJECTIVE OF THIS RESEARCH IS TO MAKE USE OF THE EXTENSIVE PARAMETRIC DATA GENERATED BY THE IMS. BY GENERATING NEW RULES FROM THE DATA BY THE MACHINE-LEARNING ALGORITHMS AND INCLUDING THEM IN THE SYSTEM, THE COGNITIVE CAPABILITIES OF THE IMS CAN BE CONTINUOUSLY UPGRADED. THE AUTOMATIC DISCRIMINATION SCHEMES TO BE TESTED AND DEVELOPED UNDER THIS PROJECT CAN BE INCORPORATED INTO THE IMS AND UPGRADED CONTINUOUSLY AS NEW DATA BECOME AVAILABLE. THIS WOULD LEAD TO THE ANTICIPATED BENEFIT OF CONTINUOUS IMPROVEMENT OF THE DISCRIMINATION CAPABILITY OF IMS.

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Topic#: 91-226
Office: MICOM
Contract #: DAAH0192CR061
PI: ROBERT GRAY
ID#: 9120796
Title: SYSTEM FOR LOCATING TANK MOUNTED GUNS
Abstract: THE OBJECTIVE OF THE PROPOSED EFFORT IS TO QUALIFY AN INNOVATIVE TECHNIQUE FOR DETECTING TANK MOUNTED GUNS USING NON-IMAGING (THERMAL) SENSORS. TWO EXPERIMENTAL STUDIES WILL BE PERFORMED TO CHARACTERIZE THE INDUCED RESPONSE OF TANK MOUNTED GUNS. THE TWO TECHNIQUES ARE QUITE DIFFERENT, ONE IS ACOUSTIC AND ONE IS ELECTROMAGNETIC, BUT THE BASIC DESIGN OF THE EXPERIMENTS IS VERY SIMILAR. A BROADBAND SOURCE WILL BE USED TO EXCITE THE GUN BARREL OF A TANK (OR A SCALE MODEL OF A TANK). MEASUREMENTS USING EXISTING SENSORS WILL BE PERFORMED TO DETERMINE THE RESPONSE OF THE GUN. VARIATIONS IN SYSTEM/EXCITATION WAVE WILL BE INCLUDED IN THE EXPERIMENT DESIGN. THE EXPERIMENTAL DATA WILL BE ANALYZED TO DETERMINE THE SIGNAL STRENGTHS AND SPECTRUM OF THE GUN RESPONSE. SUFFICIENT DATA WILL BE PROCESSED TO NORMALIZE OUT UNCERTAINTIES IN THE DATA DUE TO SOURCE VARIATIONS. AVAILABLE DISTANT DATA WILL BE USED IN ESTIMATING THE DETECTION RANGE OF EACH TECHNIQUE. ANALYTICAL MODELS WILL BE USED TO VERIFY THE EXPERIMENTAL RESULTS. ONE OF THE TECHNIQUES WILL BE SELECTED FOR DEVELOPMENT INTO A CONCEPTUAL DESIGN. THE SYSTEM CONCEPT WILL BE DETAILED ENOUGH TO INCLUDE SOURCE REQUIREMENTS, SENSORS AND PROCESSING NECESSARY FOR THE LOCATION TECHNIQUE. THE CONCEPT WILL BE DOCUMENTED IN A FINAL REPORT ALONG WITH THE EXPERIMENTAL AND ANALYTICAL RESULTS. THE COMPLETE DETECTION SYSTEM, DEVELOPED DURING PHASE II, WILL PROVIDE THE ABILITY TO LOCATE TANKS AT DISTANCES OF 2 TO 4 KM. IN ADDITION TO THE MILITARY SYSTEM APPLICATIONS, THE LOCATOR SYSTEM COULD BE UTILIZED IN TREATY MONITORING. IT COULD SERVE AS A BACK-UP TECHNIQUE TO ON-SITE INSPECTIONS AND NATIONAL TECHNICAL MEANS PROVIDING ADDITIONAL INFORMATION ON THE LOCATION OF CONCEALED OR

COVERED TANKS THAT MUST BE MONITORED UNDER THE CONVENTIONAL FORCES IN THE EUROPE TREATY.

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Topic#: 91-031
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Title: THE MANUFACTURING KNOWLEDGE SYSTEM INTEGRATION FRAMEWORK

Abstract: THE MANUFACTURING KNOWLEDGE SYSTEM (MKS) IS A PROTOTYPE FRAMEWORK FOR COMPUTER INTEGRATED MANUFACTURING (CIM) OF SEMICONDUCTORS WHICH IS UNDER DEVELOPMENT AT THE STANFORD CENTER FOR INTEGRATED SYSTEMS. THIS SYSTEM IS A SIGNIFICANT STEP FORWARD IN ADDRESSING THE ISSUES OF OPENNESS, AVAILABILITY AND MAINTAINABILITY WHICH HAVE LIMITED THE APPLICATION OF CIM TO THE STRATEGICALLY IMPORTANT SEMICONDUCTOR INDUSTRY. WHILE THIS RESEARCH PROGRAM IS STILL UNDERWAY, PRODUCT DEVELOPMENT OF SPECIFIC COMPONENTS OF THE SYSTEM MAY NOW BE UNDERTAKEN AND WILL ACCELERATE THE EFFECTIVE AVAILABILITY OF THIS SOFTWARE TO THE SEMICONDUCTOR INDUSTRY. THIS PROPOSAL ADDRESSES THE NECESSARY ELEMENTS OF TRANSFORMING THE RESULTS OF A BASIC RESEARCH PROGRAM INTO A VIABLE PRODUCT. SPECIFICALLY, PHASE I ADDRESSES THE MARKET RESEARCH AND PRODUCT DEVELOPMENT PLANNING THAT ARE ESSENTIAL PARTS OF ANY NEW PRODUCT INTRODUCTION. THEN, PHASE II IS EXPECTED TO ADDRESS THE CONVERSION AND DEMONSTRATION OF PROTOTYPICAL SOFTWARE INTO A ROBUST PRODUCT SUITABLE FOR BETA TESTING AT A PLANNED COMMERCIAL SITE AND AT SEMATECH RESULTING IN THE EARLY APPLICATION OF MKS IN INDUSTRY. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THIS COUPLING OF THE SBIR PROGRAM WITH ON-GOING BASIC RESEARCH PROVIDES CRITICAL FUNDING FOR TECHNOLOGY TRANSFER THAT OTHERWISE WOULD NOT BE AVAILABLE. IN ADDITION, THE PROPOSED PHASE II DEMONSTRATION AT SEMATECH WILL ACCELERATE THEIR CIM SCHEDULE BY AT LEAST 12 MONTHS AND EXTEND THEIR GOALS BEYOND THE WORK CELL CONTROLLERS TO THE SHOP FLOOR CONTROL LEVEL. THE EARLY AVAILABILITY OF A CIM FRAMEWORK WILL BENEFIT ALL CIM VENDORS BY PROVIDING A MUCH NEEDED STANDARD FOR SYSTEM INTEGRATION.

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Topic#: 91-052
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Contract #: DAAH0191CR309
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Title: A COMMUNICATION FRAMEWORK FOR COMPUTER SUPPORTED COOPERATIVE MECHANICAL DESIGN

Abstract: AN ENGINEERING FRAMEWORK NEEDED TO REDRESS CRITICAL INFORMATION SHARING, COMMUNICATION AND COORDINATION ISSUES THAT ARE ALL BUT IGNORED BY TODAY'S CAD SYSTEMS. THE PROPOSED PROJECT WILL COMBINE SOPHISTICATED DARPA-SPONSORED TECHNOLOGY, SUCH AS SHARED KNOWLEDGE REPRESENTATIONS AND INTELLIGENT AGENTS, WITH EMERGING MAINSTREAM INFORMATION TECHNOLOGIES LIKE HYPERMEDIA, EXPERT SYSTEMS, AND ELECTRONIC MAIL, TO CREATE A UNIQUE COMPUTER-SUPPORTED COOPERATIVE MECHANICAL DESIGN ENVIRONMENT THAT IS BOTH PRACTICAL AND TRULY USEFUL TO ENGINEERS. EACH PARTICIPANT WILL HAVE HIS/HER OWN PARTICULAR PRODUCT PERSPECTIVE AND AUTOMATED ANALYSIS TOOLS, BUT EVERYONE ON THE PROJECT WOULD BE TIED TOGETHER THROUGH SHARED ON-LINE HANDBOOKS, CATALOGS, AND NOTEBOOKS. THESE RESOURCES WOULD BE ACCESSED IN A UNIFORM FASHION VIA A HIGHLY INTUITIVE USER INTERFACE RUNNING ON EVERYONE'S WORKSTATION OR PC. PHASE I OF THIS PROJECT WILL DEVELOP A PLAN FOR INTEGRATING THE KEY TECHNOLOGIES AND EVALUATING THE POTENTIAL PRODUCTIVITY GAIN FROM APPLYING THEM IN INDUSTRIAL SETTINGS. THROUGH INTERACTIONS WITH WORKING ENGINEERS AT LOCKHEED, WE WILL FOCUS ON SYSTEM FEATURES THAT PROVIDE THE HIGHEST PRODUCTIVITY GAINS FOR THE LEAST PROGRAMMING EFFORT, AND THEN BUILD A SMALL PROTOTYPE OF THE PROPOSED ENVIRONMENT, LEVERAGING ON TOOLS ALREADY AVAILABLE IN OUR DARPA-SPONSORED RESEARCH SYSTEMS. WE WILL EVALUATE THE PROTOTYPE IN COLLABORATION WITH LOCKHEED AND OTHER

AEROSPACE COMPANIES. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS- EI TECH'S CHARTER IS TO PRODUCTIZE THE RESULTS OF ITS COLLABORATIVE RESEARCH WITH STANFORD UNIVERSITY IN CONCURRENT ENGINEERING AND INTELLIGENT CIM. THIS PROJECT WOULD SIGNIFICANTLY SHORTEN THE TIME TO TRANSFER OUR RESEARCH ON SUPPORTING DISTRIBUTED DESIGN TEAMS INTO INDUSTRIAL TOOLS.

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Topic#: 91-038 ID#: 9110418
Office:
Contract #: DAAH0191CR306
PI: PATRICK JOHNSON
Title: PARALLEL-PROCESSING SUPPORT MODULE
Abstract: BECAUSE SOFTWARE HAS BECOME A DOMINANT FACTOR INSIGNAL-PROCESSING R&D, PRODUCTIVITY DEPENDS HEAVILY ON SOFTWARE ENGINEERING ISSUES: EASE OF WRITING NEW SOFTWARE, RE-USING EXISTING SOFTWARE, AND EXCHANGING TECHNOLOGY BETWEEN DIFFERENT GROUPS. RESEARCHERS WHO USE HIGHLY PARALLEL SIMD MACHINES, OR OTHER MACHINES WITH UNCONVENTIONAL ARCHITECTURES, HAVE DIFFICULTY IN EXCHANGING TECHNOLOGY WITH USERS OF DIFFERENT MACHINES, EVEN OF THE SAME GENERAL CLASS. TO ADDRESS THIS PROBLEM, A NEW PARALLEL-PROCESSING SUPPORT MODULE WILL BE DEVELOPED TO EXTEND THE COMMERCIALLY SUCCESSFUL ENTROPIC SIGNAL PROCESSING SYSTEM (ESPS). THE DESIGN OF THIS MODULE WILL USE ADVANCED SOFTWARE-ENGINEERING TECHNIQUES TO FACILITATE WRITING SIGNAL-PROCESSING APPLICATION PROGRAMS SO THAT THEY CAN MAKE EFFECTIVE USE OF A PARALLEL MACHINE AND ARE EASILY PORTABLE FROM ONE MACHINE TO ANOTHER. THESE TECHNIQUES, WHICH INCLUDE ABSTRACT INTERFACES, OBJECT-ORIENTED PROGRAMMING, AND SELF-DESCRIBING OBJECTS, HAVE ALREADY BEEN APPLIED TO SIGNAL PROCESSING IN ESPS AND ITS GRAPHICAL INTERFACE, WAVES+, WHICH ARE RAPIDLY BECOMING POPULAR AT MANY OF THE WORLD'S LEADING SIGNAL-PROCESSING CENTERS. ESPS AND WAVES+ WILL SERVE AS A TECHNOLOGY BASE FOR THE PARALLEL-PROCESSING SUPPORT MODULE. PHASE I WILL INCLUDE A DEFINITION OF REQUIREMENTS AND DESIGN OF THE MODULE INTERFACE. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE PARALLEL-PROCESSING SUPPORT MODULE WILL BENEFIT THE FEDERAL GOVERNMENT BECAUSE OF THE CONSIDERABLE SIGNAL-PROCESSING R&D WORK ITS SUPPORTS, INCLUDING THE COMPUTATIONAL INTENSIVE SORT THAT BENEFITS FROM THE USE OF HIGHLY PARALLEL MACHINES. THE PARALLEL-PROCESSING SUPPORT MODULE WILL ENABLE THIS WORK TO PROCEED FASTER AND MORE EFFICIENTLY.

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Topic#: 91-111 ID#: 9120529
Office: DSO
Contract #: DAAH0192CR051
PI: DOUGLAS MUNNECKE
Title: DEVELOPMENT OF MICROBIAL HOST SYSTEM FOR ENVIRONMENTAL APPLICATIONS
Abstract: THE MILITARY HAS A TREMENDOUSLY WIDE RANGE OF HAZARDOUS CHEMICALS THAT NEED REMEDIATING IN BOTH SOIL AND WATER ENVIRONMENTS. MICROBIAL PROCESSES HAVE SHOWN PROMISE FOR REMEDIATING MANY OF PROBLEMS FACED BY MILITARY CLEAN UP EFFORTS INVOLVING HYDROCARBON FUELS, SOLVENTS, GREASE, PESTICIDES, AMMUNITIONS AND NERVE AGENTS. IN ADDITION TO POTENTIAL WIDESPREAD APPLICATIONS, BIOLOGICAL REMEDIATION PROCESSES TEND TO OFFER LOW COSTS IN COMPARISON TO INCINERATION AND CHEMICAL TECHNOLOGY. THE OBJECTIVE OF THIS PROPOSED RESEARCH PROGRAM WILL BE TO DEVELOP AN ENVIRONMENTAL MICROBIAL HOST SYSTEM, MUCH LIKE THE INDUSTRIAL MICROBIAL HOSTS USED IN THE INDUSTRIAL ENZYME AND BIOPHARMACEUTICAL INDUSTRIES TO PRODUCE DESIRED PRODUCTS. IN THIS CASE HOWEVER, THE HOST ORGANISM WILL BE DEVELOPED TO HAVE THE BASIC PROPERTIES REQUIRED FOR ENVIRONMENTAL APPLICATIONS AND SERVE AS A VEHICLE FOR CARRYING THE SPECIFIC METABOLIC FUNCTIONS REQUIRED FOR A GIVEN REMEDIATION TASK. THIS WILL ALLOW FOR RAPID TECHNOLOGY DEVELOPMENT AND MARKET INTRODUCTION INTO THE EXPECTED $200-300 MILLION/YEAR BIOREMEDIATION MARKETS.

HAVING A MICROBIAL HOST SYSTEM FOR ENVIRONMENTAL APPLICATIONS WILL DRAMATICALLY SPEED UP THE DEVELOPMENT PROCESS OF BIOTECHNOLOGY FOR THE REMEDIATION OF HAZARDOUS WASTES IN BOTH SOIL AND WATER ENVIRONMENTS.

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Topic#: 91-111 ID#: 9120395
Office: DSO
Contract #: DAAH0192CR062
PI: CARL OVERPECK
Title: MOBILE HAZARDOUS WASTE REMEDIATION SYSTEM
Abstract: ENVIRONMENTAL PHYSICS, INCORPORATED (EPI) PROPOSES TO DEMONSTRATE THE FEASIBILITY AND THE DESIGN OF A MOBILE HAZARDOUS WASTE REMEDIATION SYSTEM IN PHASE 1. THIS EFFORT IS BUILT ON EXTENSIVE RESEARCH INFORMATION OF A PROTOTYPE PLASMA TORCH AND FIELD EXPERIENCE OF CLEANING UP HAZARDOUS WASTES. EPI'S MOBILE SYSTEM COMBINES EXISTING ROTARY KILN TECHNOLOGY WITH AN ADVANCED PLASMA TORCH AND SEPARATOR. ON ACCOUNT OF ITS HIGH ELECTRON TEMPERATURE, THE INTEGRATED SYSTEM ACHIEVES THE COMPLETE DISSOCIATION OF WASTE INTO CHARGED MOLECULES AND IONS WHICH ARE SEPARABLE AND COLLECTIBLE IN STABLE AND BENIGN STATES. EPI'S UNDERSTANDING OF THE PHYSICS OF THE PLASMA TORCH PERMITS IT TO SCALE THE RESULTS FROM A LABORATORY DEVICE INTO A FIELD OPERATING UNIT. KEY BENEFITS OF EPI'S MOBILE HAZARDOUS WASTE REMEDIATION SYSTEM INCLUDE: FIELD OPERABILITY; DESTRUCTION REMOVAL EFFICIENCY (DRE) OF AT LEAST 99.99%; SUITABILITY FOR USE ON DIOXIN, HALOGENATED SOLVENTS, HYDROCARBON AND SIMILAR WORK STREAMS; HIGH LEVEL OF SAFETY WITH CONTINUOUS DIAGNOSTIC MONITORING; COMPLIANCE WITH EXISTING EPA REGULATIONS; REMEDIATION COST COMPARABLE TO CURRENT TECHNOLOGIES ($500/TON).

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Topic#: 91-002 ID#: 9110481
Office:
Contract #: DAAH0191CR190
PI: VINCENT POOR
Title: ACT-BASED SIGNAL PROCESSING FOR NEAR-FAR RESISTANT DIRECT-SEQUENCE SPREAD SPECTRUM
Abstract: DIRECT-SEQUENCE SPREAD-SPECTRUM MULTIPLE-ACCESS (DS/SSMA) IS THE TECHNOLOGY OF CHOICE IN A WIDE VARIETY OF MILITARY RADIO NETWORKS WHERE MULTIPLE-ACCESS CAPABILITIES, ANTI-JAMMING, LOW PROBABILITY OF INTERCEPT, AND DYNAMIC TOPOLOGIES ARE IMPORTANT. THE PRINCIPAL SHORTCOMING OF OPERATIONAL RADIO NETWORKS USING DS/SSMA COMMUNICATION SYSTEMS IS THE NEAR-FAR PROBLEM, WHICH REFERS TO THE (POSSIBLY SEVERE) PERFORMANCE DEGRADATION CAUSED BY THE DISSIMILARITY OF THE RECEIVED POWERS OF A SET OF USERS WHO TRANSMIT SIMULTANEOUSLY THROUGH THE SAME CHANNEL. THE EMERGING DISCIPLINE OF MULTIUSER DETECTION HAS OPENED THE THEORETICAL POSSIBILITY OF OBTAINING DEMODULATORS THAT ARE IMMUNE TO THE NEAR-FAR PROBLEM. THIS PRESENTS A VERY SIGNIFICANT WINDOW OF OPPORTUNITY FOR THE DEVELOPMENT OF THE NEXT GENERATION OF DS/SSMA DEMODULATORS. THESE MULTIUSER DEMODULATORS REQUIRE THE IMPLEMENTATION OF WIDEBAND PROGRAMMABLE MATCHED FILTERS WITH HIGH DATA RATES AND LARGE TIME-BANDWIDTH PRODUCTS, AND WITH VERY SHORT PERIODS BETWEEN READJUSTMENT OF TAPS. ACOUSTIC CHARGE TRANSPORT (ACT) TECHNOLOGY CONSTITUTES THE MOST PROMISING TECHNOLOGY WITH WHICH TO IMPLEMENT SUCH STRUCTURES, AND THEREBY TO REALIZE THESE GAINS IN PRACTICE. THUS, IT IS THE OVERALL OBJECTIVE OF THE PROPOSED PROJECT TO DEVELOP ACT-BASED SIGNAL PROCESSING ARCHITECTURES FOR NEAR-FAR-RESISTANT DEMODULATION OF DS/SSMA SIGNALS. THIS GENERAL OBJECTIVE CAN BE BROKEN DOWN INTO SEVERAL INTERMEDIATE AND SPECIFIC OBJECTIVES FOR PHASE I, INCLUDING THE DERIVATION OF IMPLEMENTABLE FORMS OF NEAR-FAR RESISTANCE ALGORITHMS; THE DEVELOPMENT OF ACT SIGNAL-MICROPROCESSOR-BASED SIGNAL PROCESSING ARCHITECTURES TO IMPLEMENT THESE ALGORITHMS; THE ASSESSMENT OF THE IMPROVEMENT IN BIT-ERROR RATES THAT CAN BE ACHIEVED BY THESE NEW ARCHITECTURES; AND THE ASSESSMENT OF THE RANGES OF FORMAT PARAMETERS FOR WHICH THESE ARCHITECTURES ARE

PRACTICAL. THE RESULTS OF THIS PHASE I EFFORT WILL LEAD DIRECTLY TO A PHASE II EFFORT IN WHICH THE MOST PROMISING NEAR-FAR-RESISTANT SIGNAL PROCESSING ARCHITECTURES IDENTIFIED IN PHASE I WILL BE DEVELOPED.

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Topic#: 91-055 ID#: 9110837
Office:
Contract #: DAAH0191CR299
PI: RAMA RAO

Title: HIGHLY SENSITIVE FAR INFRARED SENSOR FABRICATED WITH HIGH TC TL-BA-CA-CU-O SUPERCONDUCTOR THIN FILMS

Abstract: IN THE PROPOSED PROGRAM, FOR THE FIRST TIME, FEASIBILITY OF DEVELOPING AND CHARACTERIZING HIGHLY SENSITIVE BOLOMETER IN THE 10-100 μM WAVELENGTH REGION USING HIGH TEMPERATURE T1-BA-CA-CU-O SUPERCONDUCTING THIN FILM, IS EXAMINED. THESE MATERIALS BECAUSE OF THE LOW BAND GAP ENERGY ($\approx$ 25 MEV) AND SHARP TRANSITION TEMPERATURE, THEY ARE INHERENTLY CAPABLE OF DETECTING RADIATION OVER A WIDE WAVELENGTH RANGE DOWN TO 100 μM WITH A HIGH SENSITIVITY. FURTHERMORE BECAUSE OF TC $\approx$ 125 K, THEY CAN BE OPERATED EFFICIENTLY AT LIQUID NITROGEN TEMPERATURE. RECENTLY, IN A PRELIMINARY EXPERIMENT, WE HAVE OBSERVED A HIGHLY SENSITIVE (10 V/W) BOLOMETRIC RESPONSE WITH YBCO FILMS SUBJECTED TO 0.5 μM LASER RADIATION AT OR ABOVE THE TRANSITION TEMPERATURE. THIS WORK WAS THE WORLD'S FIRST DEMONSTRATION OF BOTH EQUILIBRIUM AND NON-EQUILIBRIUM DETECTION MADE IN THIS NEW CLASS OF HIGH TEMPERATURE SUPERCONDUCTOR. IN THE PROPOSED WORK, EXTREMELY SMOOTH AND OPTICALLY SEMI-TRANSPARENT T1-BA-CA-CU-O SUPERCONDUCTING FILMS AS THIN AS 80 NM DEPOSITED ON SUITABLE SUBSTRATES BY PLASMA ASSISTED LASER DEPOSITION TECHNIQUE WILL BE PURCHASED. IN ORDER TO IMPROVE THE RESPONSIVITY OF THE DETECTOR, THESE FILMS WILL BE PATTERNED IN A MEANDER SHAPE BY LASER INDUCED ETCHING PROCESS. FOR INFRARED DETECTION, A 10.6 μM CO2 LASER SOURCE WILL BE MODULATED AND GUIDED THROUGH AN OPTICAL FIBER TO THE DETECTOR. IN PHASE I, THERMAL RESPONSE OF THESE DETECTORS AT 10.6 μM, TEMPERATURE AND WAVELENGTH (10-100 μM) DEPENDENCE OF THE RESPONSE WILL BE STUDIED. THE RESPONSIVITY OF THE DETECTOR IS ESTIMATED TO BE TEN TO THE POWER FOUR VOLTS PER WATT WHICH IS SEVERAL ORDERS OF MAGNITUDE HIGHER THAN PRESENTLY AVAILABLE ANY KIND OF DETECTORS OPERATING AT LIQUID NITROGEN TEMPERATURE IN THE SUB-MM REGION. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE POTENTIAL COMMERCIAL APPLICATIONS OF THESE DEVICES ARE IN THE AREA OF SUB-MM SPECTROMETER, RADIOMETER, NIGHT VISION, AND OPTICAL COMMUNICATIONS.

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Topic#: 91-136 ID#: 9120783
Office: SPO
Contract #: DAAH0192CR121
PI: BERND ZIMMERMANN

Title: OPTICAL FIBER TIME DOMAIN SENSOR NETWORKS

Abstract: WE PROPOSE AN ALL-DIELECTRIC FIBER OPTIC TIME DOMAIN SENSOR NETWORK WHICH ALLOWS QUASI-DISTRIBUTED, REAL TIME STRAIN, TEMPERATURE, AND PRESSURE MONITORING. THE SYSTEM PROVIDES FAST DATA RATES, PROVIDES LOW SIGNAL ATTENUATION, OFFERS IMMUNITY TO CORROSION AND ELECTRO-MAGNETIC INTERFERENCE, AND REDUCES NETWORKING COMPLEXITY. THE PROPOSED FIBER ARRAY IS AMENABLE TO SUBMERSED AND/OR BURIED APPLICATIONS, AND MAY OPERATE OVER A WIDE TEMPERATURE RANGE. THE SENSORS ARE BASED ON TIME DOMAIN PRINCIPLES WHERE PARAMETERS TO BE MONITORED ARE DETERMINED FROM CHANGES IN OPTICAL PULSE TIME OF FLIGHT. NOVEL FIBER OPTIC REENTRANT LOOP TECHNOLOGY IS PROPOSED TO ALLOW UNPRECEDENTED TIME DOMAIN MEASUREMENT RESOLUTION. THE PROPOSED SYSTEM OFFERS EXTREMELY RELIABLE, MULTI-PARAMETER, QUASI-DISTRIBUTED SENSING CAPABILITIES. COMMERCIAL APPLICATIONS INCLUDE PLANT ENVIRONMENTS, BUILDING SAFETY, AND QUANTITATIVE NON-DESTRUCTIVE EVALUATION.

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Topic#: 91-010 ID#: 9110787
Office:
Contract #: DAAH0191CR231
PI: ARNIS MANGOLDS

Title: NONLETHAL BALLISTICALLY DEPLOYED SNARE NETS

Abstract: A MEANS OF BALLISTICALLY DEPLOYING A SNARE NET IS PROPOSED. THE SYSTEM MAY BE USED TO DELAY, CONFUSE OR INCAPACITATE INDIVIDUALS OR CROWDS IN THE OPEN OR IN CONFINED SPACES. THE SYSTEM CAN BE CONFIGURED TO BE LAUNCHED VIA BULLET TRAP, 40MM GRENADE LAUNCHER OR VIA SPECIALLY BUILT LAUNCH TUBE. A NUMBER OF APPLICATIONS ARE SUGGESTED, EACH WITH UNIQUE DESIGN CONSIDERATIONS. THE PRIMARY PROBLEM ISA BALANCE OF MAINTAINING DEPLOYMENT OVER A USEABLE RANGE WHILE ENSURING THE ENERGY CONTENT IS UNDER LETHAL LIMITS. A UNIQUE MEANS OF CONTROL DRAG AND MOMENTUM IS SUGGESTED. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE PROPOSED MECHANISM PROVIDES A NONLETHAL MEANS OF DETAINING PERSONNEL FOR PURPOSES OF PREVENTING ESCAPE, ATTACK OR UNWARRANTED MOVEMENT. LAW ENFORCEMENT AGENCIES AS WELL AS SPECIAL OPERATIONS UNITS MAY FIND IMMEDIATE APPLICATION. FORCE PROTECTION IN SENSITIVE LIC ENVIRONMENTS OR PROTECTION OF CRITICAL INSTALLATIONS WILL FIND A NEED FOR SUCH A SYSTEM.

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Topic#: 91-025 ID#: 9110362
Office:
Contract #: DAAH0191CR228
PI: MARK DRUY

Title: NOVEL IN SITU FIBER OPTIC FTIR SENSOR TO CONTROL CVD PROCESSES

Abstract: FOSTER-MILLER PROPOSES TO DEVELOP A NOVEL IN SITU FIBER OPTIC FTIR SENSOR TO CONTROL CHEMICAL VAPOR DEPOSITION PROCESSES AND PLASMA ETCHING OF SEMICONDUCTORS. THIS NEW PROCESS CONTROL SYSTEM WILL BE BASED ON FOSTER-MILLER'S HIGHLY SUCCESSFUL REMOTE FIBER OPTIC FTIR POLYMER REACTION MONITOR. THIS DEVICE WAS DEVELOPED BY FOSTER-MILLER TO MONITOR AND CONTROL POLYMERIC REACTIONS IN HOSTILE ENVIRONMENTS, AND IS A WINNER OF A 1990 R&D 100 AWARD. IN PHASE I, FOSTER-MILLER WILL TEAM WITH SPIRE CORPORATION TO DEMONSTRATE KEY ELEMENTS OF THE SYSTEM. WE WILL DEMONSTRATE THAT THE FIBER OPTIC FTIR DEVICE MEASURE GAS PHASE COMPOSITIONS OF III-V INGAASP PRECURSORS IN REAL-TIME IN ATYPICAL MOCVD REACTOR. WE SHALL RESOLVE KEY ISSUES OF PRACTICAL IMPLEMENTATION SO THAT THE SYSTEM WILL BE READY FOR IMMEDIATE INTEGRATION INTO AN MOCVD REACTOR. IN CONJUNCTION WITH SPIRE CORPORATION, WE WILL INTEGRATE THE PROCESS MONITOR INTO AN MOCVD SYSTEM IN PHASE II. REPRODUCIBLE GROWTH OF INGAASP EPILAYERS WITH IMPROVED UNIFORMITY IN PHASE II WILL PROVIDE A FIRM BASIS FOR A COMMERCIALLY SUCCESSFUL PHASE III MARKET INTRODUCTION. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE PRECISE, REAL-TIME MEASUREMENT AND CONTROL OF GAS PHASE REACTANTS IN CVD PROCESS REACTORS WILL SIGNIFICANTLY IMPROVE THE YIELD AND REPRODUCIBILITY OF CVD AND PLASMA ETCHED SEMICONDUCTORS. THIS WILL RESULT IN SIGNIFICANT REDUCTION IN THE COST OF A BROAD VARIETY OF ELECTRONIC AND OPTOELECTRONIC DEVICES TO DOD. IT COULD WELL LEAD TO SIGNIFICANT ENHANCEMENT OF THE UNITED STATES' ABILITY TO COMPETE WITH OTHER TECHNICALLY ADVANCED ECONOMIES IN THE PRODUCTION AND MARKETING OF ADVANCED SEMICONDUCTORS.

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Topic#: 91-070 ID#: 9110800
Office:
Contract #: DAAH0191CR226
PI: ROBERT KOVAR

Title: SOL-GEL TRANSFER MOLDING OF CERAMIC MATRIX COMPOSITES

Abstract: THE INNOVATION WE PROPOSE, "SOL-GEL TRANSFER MOLDING" (SGTM), USES A NEW SOL-GEL TECHNIQUE AND A FIBER PREFORM TO PRODUCE NEAR NET-SHAPE, LOW COST, HIGH PERFORMANCE,

CERAMIC MATRIX COMPOSITES (CMCS) COST EFFECTIVELY. THIS NEW SOL-GEL PROCESS USES A PROCESSING AID AND AS A RESULT YIELDS CRACK-FREE CERAMIC OXIDES WITH GREATER THAN 90 PERCENT THEORETICAL DENSITY (COMPARED TO ONLY 50 PERCENT FOR CONVENTIONAL SOL-GEL PROCESS). THIS ADDRESSES ALL THE KEY PROBLEMS SUCH AS SHRINKAGE, MICROPOROSITY, AND CRACKING, WHICH HAVE LONG HINDERED THE MORE WIDE-SPREAD USE OF SOL-GEL PROCESS FOR COMPOSITES. OUR APPROACH IS BASED ON "RESIN TRANSFER MOLDING," WIDELY USED IN THE PLASTICS INDUSTRY FOR FIBER REINFORCED COMPOSITES, AND WILL INVOLVE INTRODUCING A LOW VISCOSITY SOL-GEL SOLUTION INTO A SPECIALLY DESIGNED MOLD CONTAINING A FIBER PREFORM. COMPLEX SHAPES WITH MINIMUM POST-PROCESS MACHINING CAN BE MADE BY THIS TECHNIQUE. THE PHASE I WILL DEMONSTRATE THE FEASIBILITY OF THIS TECHNOLOGY BY (A) DESIGNING AND TESTING OF A SOL-GEL TRANSFER MOLDING APPARATUS: (B) FABRICATING CYLINDRICAL PARTS OF ONE OXIDE COMPOSITION, (C) CHARACTERIZING THE TOUGHNESS, MICROSTRUCTURE, AND MECHANICAL PROPERTIES OF THE RESULTING COMPOSITES, AND (D) SUGGESTING DESIGN IMPROVEMENTS FOR THE PHASE II PROGRAM. THE PHASE II PROGRAM WILL OPTIMIZE THE PROCESS FOR MAXIMUM STRENGTH, TOUGHNESS AND HIGH TEMPERATURE PERFORMANCE. WE WILL FABRICATE MORE STRENGTH, TOUGHNESS AND HIGH TEMPERATURE PERFORMANCE. WE WILL FABRICATE MORE COMPLEX GEOMETRIES (SUCH AS ROTOR BLADES) USING REINFORCING FIBERS AND TWO CERAMIC MATRICES OF INTEREST TO THE DARPA. THE SUCCESS OF THE PROPOSED APPROACH WILL PROVIDE THE DOD WITH A RAPID, COST-EFFECTIVE MEANS OF PRODUCING HIGH PERFORMANCE COMPLEX GEOMETRY CMCS.

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Topic#: 91-099 ID#: 9120294
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Contract #: DAAH0192CR166
PI: JOHN GASSNER

Title: CERAMIC SHIELDS FOR SATELLITE PROTECTION AGAINST HYPERVELOCITY IMPACT

Abstract: IN THIS EFFORT, FOSTER-MILLER PROPOSES TO EXAMINE A TRULY INNOVATIVE APPROACH FOR PROTECTING SATELLITES AGAINST DEBRIS PARTICLES OR OTHER PROJECTILES TRAVELING AT HYPERVELOCITIES OF 5 TO 20 KM/SEC. TO DEMONSTRATE THE FEASIBILITY OF THIS APPROACH, WE WILL CONDUCT A PHASE I PROGRAM INVOLVING BOTH HYPERVELOCITY TESTING AND ANALYSIS. OUR PHASE I TEAM INCLUDES WELL-KNOWN AND RECOGNIZED EXPERTS IN BOTH OF THESE AREAS. THIS INTRIGUING APPROACH USES A CERAMIC IN CONJUNCTION WITH METALLIC MATERIALS WHICH SERVE AS "FRAGMENTORS" TO DESTROY THE PROJECTILE AS IT IMPACTS THE SHIELD. THIS MATERIAL ACTS AS A DUAL MODE, DEBRIS-FRAGMENTING COMPOSITE TO DISINTEGRATE THE PARTICLE AND DISPERSE IT HARMLESSLY. INCLUDED IS THE POTENTIAL FOR ENHANCED STRUCTURAL SURVIVABILITY THROUGH THE USE OF CELLULAR CONSTRUCTION. A MAJOR BENEFIT IS THREAT ADAPTABILITY - THE ABILITY TO ACHIEVE VARIABLE PROTECTION LEVELS TO MEET AN EVOLVING THREAT. MOREOVER, THE MATERIALS CONCEPT IS APPLICABLE TO TRUE STANDOFF BUMPER SHIELDS OR APPLIQUES. THE ANALYSIS TASK INCLUDES MATERIAL PREDESIGN EFFORT (SHIELD MICROMECHANICAL DESIGN) AS WELL AS SHIELD CONFIGURATION DESIGN AND, IF APPROPRIATE, SIMULATION USING THE PC-BASED HYDROCODE ZEUS. EXPERIMENTAL EFFORT INCLUDES TWO HYPERVELOCITY TESTS TO PROVIDE TESTS TO PROVIDE ADDITIONAL INFORMATION ON CONCEPT FEASIBILITY. THE POTENTIAL BENEFITS OF THIS PROGRAM INCLUDE DEVELOPMENT OF AN APPROACH TO TAKE MAXIMUM ADVANTAGE OF THE CAPABILITIES OF CERAMICS AND THEIR COMPOSITES, WHILE MINIMIZING THEIR DISADVANTAGES. THESE MATERIALS POSSESS HIGHER MODULUS AND ARE MORE DENSE THAN ALUMINUM, AND BOTH OF THESE FACTORS ARE PARTICULARLY ADVANTAGEOUS IN THE HYPERVELOCITY ENVIRONMENT. MOREOVER, THEIR HIGH HARDNESS MAY ASSIST IN FRAGMENTING DEBRIS. A SUCCESSFUL PROGRAM COULD RESULT IN CONSIDERABLY IMPROVED LEVELS OF PROTECTION FOR BOTH MILITARY AND COMMERCIAL SPACECRAFT.

FOSTER-MILLER, INC.
350 SECOND AVENUE
WALTHAM, MA 02154

Topic#: 91-100 ID#: 9120207
Office: DSO
Contract #: DAAH0192CR173

Phone: (617) 890-3200 PI: HARRIS GOLD
Title: SUPERCRITICAL FLUID PROCESSING OF HEAVY METALS
Abstract: SUPERCRITICAL EXTRACTION HAS SEVERAL ADVANTAGES OVER CONVENTIONAL PROCESSES INCLUDING BENIGN SOLVENTS, ENHANCED MASS TRANSFER, AND THE INHERENT CAPABILITY OF SEPARATING MIXTURES OF EXTRACTED MATERIAL. HOWEVER, SUPERCRITICAL EXTRACTION IS NOT GENERALLY APPLIED TO INORGANIC SUBSTANCES BECAUSE THESE ARE RELATIVELY INSOLUBLE IN NON-POLAR SOLVENTS SUCH AS SUPERCRITICAL CARBON DIOXIDE. UP TO NOW, THIS HAS EXCLUDED THE POSSIBILITY OF TREATING BY SUPERCRITICAL SOLVENT EXTRACTION THE MANY METAL-CONTAINING HAZARDOUS WASTE STREAMS GENERATED IN DOD OPERATIONS. THE INNOVATIVE TECHNIQUE PROPOSED HERE RENDERS CARBON DIOXIDE AND OTHER NONPOLAR SOLVENTS CAPABLE OF DISSOLVING METALS AND THEIR SALTS, AND EXTENDS THE PROCESSING CAPABILITIES OF SUPERCRITICAL TECHNOLOGY TO METAL-CONTAINING WASTES. IN THE ENVISAGED PROCESS, MIXTURES OF METALS WILL BE EXTRACTED FROM CONTAMINATED SLUDGES AND SOILS AND WILL BE SEPARATED AND CONCENTRATED INTO INDIVIDUAL METALS FOR RECYCLE, SALE OR DISPOSAL. FURTHERMORE, THE ORGANIC COMPLEXING AGENT USED TO SOLUBILIZE THE METALS REMAINS IN THE SOLVENT AND IS RECYCLED IN THE EXTRACTION STAGE. THE AVAILABILITY OF A PROCESS FOR EXTRACTING, SEPARATING AND CONCENTRATING METALS THAT DOES NOT REQUIRE A TOXIC SOLVENT WILL PROVIDE THE FEDERAL GOVERNMENT AND THE EPA WITH THE CAPABILITY NEEDED TO SUPPORT THE MORE STRINGENT CLEAN AIR AND CLEAN WATER ACTS CURRENTLY BEING LEGISLATED. THE DOD WILL BE ABLE TO PURIFY METAL-CONTAINING HAZARDOUS SLUDGES AND SANDS CONTAMINATED WITH DEPLETED URANIUM, AND TO RESTORE SOILS PREVIOUSLY CONTAMINATED WITH SPENT PLATING BATHS. COMMERCIAL APPLICATIONS INCLUDE HAZARDOUS WASTE PROCESSING SUCH AS SOLID WASTES FROM BOILERS AND FURNACES.

FOSTER-MILLER, INC. Topic#: 91-124 ID#: 9121113
350 SECOND AVENUE Office: LSO
WALTHAM, MA 02154 Contract #:
Phone: (617) 890-3200 PI: MARTIN SMIRLOCK
Title: UNIQUE/NOVEL LIGHTWEIGHT APPLIQUE ARMOR ATTACHMENT TECHNOLOGIES
Abstract: AS PART OF THE REVIEW OF THE CURRENT STATE OF THE ART ON ATTACHMENT SYSTEMS WE WILL SELECT TWO CANDIDATE SYSTEMS THAT HAVE A HIGH LIKELIHOOD FOR SUCCESS BASED ON THE CRITERIA ESTABLISHED IN SUBSECTION C.2. A MODEL OF EACH OF THESE CANDIDATES WILL BE REVIEWED AN TESTED FOR EASE OF ATTACHMENT, REPEATABILITY, AND PRODUCIBILITY. IT IS ENVISIONED THAT THE MODEL WILL DEMONSTRATE BOTH ITS ATTACHMENT AND RELEASE MECHANISMS WHILE ATTACHED TO CERAMIC TILES AND A SIMULATED HULL STRUCTURE. A PHASE II WILL FURTHER REFINE THIS TECHNOLOGY FOR DEMONSTRATION ON A FULL-SCALE MOCK-UP OF THE ATTACHMENT CONCEPTS. IN PARALLEL WITH THE DEVELOPMENT OF THE ATTACHMENT CONCEPTS, WILL BE THE DEVELOPMENT OF A COMPUTER MODEL THAT SIMULATES HULL RESPONSES. THE SUCCESSFUL DEVELOPMENT OF THIS COMPUTER MODEL WILL EVALUATE CANDIDATE ATTACHMENT SYSTEMS BASED ON SIMULATING STRUCTURAL RESPONSES AND POSSIBLY BALLISTIC MECHANICS, THIS IS UNLIKELY IN PHASE I BUT CAN BE DONE IN PHASE INTEGRITY. THE VALUE OF SUCH A PROGRAM WOULD BE IN THE ABILITY TO PREDICT HOW ATTACHMENT SYSTEM (ANY SYSTEM) REACTS TO HIGH VELOCITY BALLISTIC. PHASE I SHOULD CULMINATE IN A WORKING COMPUTER MODEL THAT DEMONSTRATES HOW AN ATTACHMENT SYSTEM WILL REACT TO A BALLISTIC PENETRATOR. DURING PHASE II FURTHER REFINEMENT OF THE MODEL WILL BE USED TO VALIDATE THE COMPUTER MODEL BY COMPARING THE PROJECTED RESULTS WILL ACTUAL TEST DATA USING A COMBINATION OF LAST(TM) ARMOR OR ONE OF THE SUCCESSFUL PHASE I SYSTEMS. A SUCCESSFUL PHASE II WILL PROVIDE A TOOL FOR ARMOR DEVELOPERS THAT PROVIDES THEM THE MEANS TO EVALUATE APPLIQUE ARMOR FOR BALLISTIC PERFORMANCE OR IDENTIFY CERTAIN IMPACT PARAMETERS FOR EVALUATION. A SUCCESSFUL COMPUTER MODEL SHOULD SAVE MONEY IN BOTH DEVELOPMENT AND TESTING COSTS BY ALLOWING THE DEVELOPERS TO EVALUATE THEIR PRODUCTS ON A COMPUTER.

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Topic#: 91-136 ID#: 9120082
Office: SPO
Contract #: DAAH0192CR199
PI: ARTHUR NELSON

Title: INTEGRATED FIBER OPTICS/PHOTONICS SYSTEM FOR NETTED SENSOR SYSTEMS

Abstract: FOSTER-MILLER PROPOSES THE DESIGN AND DEVELOPMENT OF AN EFFICIENT PASSIVE MULTIPLEXING SCHEME FOR SCALE FIBER OPTIC SENSOR SYSTEMS. THIS SYSTEM WILL BE CAPABLE OF COLLECTING THE DATA FROM A LARGE NUMBER OF DIVERSE FIBER OPTIC SENSORS, TELEMETERING THE DATA USING EMI-FREE FIBER CABLE, AND PRESENTING THE DATA FOR COMPUTER ANALYSIS AND GRAPHICAL DISPLAY. IN PHASE I, FOSTER-MILLER WILL INVESTIGATE A MULTIPLEXING APPROACH SUITABLE FOR FIBER OPTIC SENSOR SYSTEMS THAT REQUIRES NO ELECTRICAL POWER AT THE SENSOR LOCATIONS AND YET ALLOWS THE SIGNALS FROM MANY SENSORS TO BE CARRIED ON A SINGLE FIBER. THE INHERENTLY PASSIVE NATURE OF THE FOSTER-MILLER APPROACH IS EXTREMELY IMPORTANT, SINCE THE REQUIREMENT OF ELECTRICAL POWER AT OPTICAL SENSOR LOCATIONS NEGATES MOST OF THE ADVANTAGES OF FIBER OPTIC SENSING AND TRANSMISSION AND IMPOSES AN IMPOSSIBLE POWER AND HEATING BURDEN FOR LARGE SYSTEMS. THIS PASSIVE MULTIPLEXING APPROACH BORROWS HEAVILY FROM RADAR TECHNOLOGY, USING SHORT PULSES OR ENCODED WAVEFORMS FROM A CENTRALIZED LASER TRANSMITTER TO INTERROGATE THE STATUS OF THE FIBER OPTIC SENSOR SYSTEM. TDM, FDM, AND PULSE COMPRESSION TECHNIQUES WILL BE STUDIED AND AN OPTIMUM ALGORITHM FOR THE DESIGN OF A LARGE-SCALE SENSOR SYSTEM TO BE CONSTRUCTED IN PHASE II WILL BE DEVELOPED. DEVELOPMENT OF LARGE-SCALE INTEGRATED FIBER OPTIC SENSOR SYSTEMS WILL GREATLY EXTEND THE USEFULNESS AND POTENTIAL OF EXISTING FIBER OPTIC SENSORS TO MANY ADDITIONAL AREAS INCLUDING AVIONIC SYSTEMS, INDUSTRIAL PROCESSING PLANTS, ADVANCED WEAPONS SYSTEMS, SMART BUILDINGS, AND OTHER APPLICATIONS.

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Topic#: 91-036 ID#: 9110423
Office:
Contract #: DAAH0191CR293
PI: JONAH JACOB

Title: COMPILER TECHNOLOGY FOR SCALABLE PARALLEL COMPUTERS

Abstract: THE WORLD OF PARALLEL PROCESSORS IS SEEING A SIGNIFICANT LAG BETWEEN HARDWARE AND SOFTWARE. THE PROBLEM FACED BY PARALLEL PROGRAMMERS, AKIN TO THAT FACED BY EARLY ASSEMBLER PROGRAM WRITERS, IS THE LACK OF ADEQUATE COMPILERS, WHICH WOULD INSULATE PROGRAMMERS FROM THE LOW-LEVEL ARCHITECTURAL DETAILS, CONTRIBUTING TO RAPID PROGRAM SYNTHESIS AND PORTABILITY. THE FIRST STEPS TOWARD THIS GOAL HAVE BEEN TAKEN BY THE DO-LOOP PARALLELIZING COMPILERS, USED PREDOMINANTLY FOR PARALLEL FORTRAN. A MORE GENERALIZED APPROACH, FOR POINTER-BASED LANGUAGES, IS PRESENTED IN THE CURARE WORK. IN THIS PROPOSAL WE INTEND TO INCORPORATE BOTH THESE TECHNIQUES AND FURTHER THIS GOAL THROUGH THE USE OF OUR COMPILER EXPERTISE. WE SHALL INVESTIGATE THE USE OF DECLARATIONS TO AID THE COMPILER IN AUTOMATIC DETECTION OF PARALLELISM. FURTHER, WE WILL PIPELINE AND PARALLELIZE THE COMPILER ITSELF, THEREBY FURTHER INCREASING SOFTWARE PRODUCTIVITY. IT IS CONTENDED THAT AN EFFICIENT MACHINE-INDEPENDENT INTERFACE THAT RELIEVES PARALLEL PROGRAMMERS OF HAVING TO DEAL WITH ARCHITECTURAL DETAILS WILL GREATLY ENHANCE THE WRITING OF PARALLEL PROGRAMS, REGARDLESS OF APPLICATION. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - ACHIEVING THE GOALS IN PHASE I WILL PROVIDE A FOUNDATION FOR FURTHER COMPILER PARALLELIZATION, PERFORMANCE TUNING, AND INTEGRATION OF MORE PARALLELIZED PROGRAMMING PRODUCTIVITY TOOLS (SUCH AS DECLARATIONS) IN PHASE II. GIVEN THAT AN EFFICIENT PARALLEL COMPILER WOULD BE THE SINGLE MOST IMPORTANT FACTOR IN BRIDGING THE GAP BETWEEN PARALLEL HARDWARE AND SOFTWARE ADVANCES, ALL APPLICATIONS USING PARALLEL LANGUAGES WOULD BENEFIT FROM THIS WORK, INCLUDING PARALLEL DATABASES, PARALLEL IMPLEMENTATION OF NEURAL NETWORKS, PARALLEL IMAGE AND SPEECH PROCESSING, DISTRIBUTED AI AND EXPERT SYSTEMS AND OTHER PARALLEL APPLICATIONS.

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Topic#: 91-021 ID#: 9110090
Office:
Contract #: DAAH0191CR176
PI: ROBERT ANHOLT

Title: PROCESS AND DEVICE MODELS FOR HEMT MM-WAVE TECHNOLOGY

Abstract: A COMBINED PROCESS AND DEVICE MODELING COMPUTER PROGRAM FOR HIGH-ELECTRON MOBILITY TRANSISTOR (HEMT) MM-WAVE TECHNOLOGY WILL BE DEVELOPED. THE PROGRAM WILL ALLOW ENGINEERS TO TRY OUT DIFFERENT TYPES OF TRANSISTOR DOPING, LAYER THICKNESSES, AND FET LAYOUTS BY COMPUTING I-V CHARACTERISTICS, EQUIVALENT-CIRCUIT PARAMETERS, AND S-PARAMETERS. THE KEY FEATURES OF THIS PROPOSAL ARE THE DEVELOPMENT OF A POISSON/SCHROEDINGER EQUATION SOLVER FOR OBTAINING THE CARRIER DENSITIES FOR ARBITRARY GATE VOLTAGES, THE DEVELOPMENT OF AN I-V MODULE THAT USES THE CARRIER DENSITIES TO COMPUTE THE SOURCE-DRAIN CURRENT AND SMALL-SIGNAL PARAMETERS, THE INCORPORATION OF THOSE MODULES INTO A EASY-TO-USE PROGRAM FOR THE ANALYSIS OF A WIDE VARIETY OF HEMT STRUCTURES, AND THE COMPARISON OF THE RESULTS WITH DATA OBTAINED FROM GOVERNMENT AND INDUSTRY MM-WAVE MMIC PROGRAMS. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THIS PROGRAM IS DESIGNED TO HELP ADVANCE THE STATE OF THE ART OF MM-WAVE TECHNOLOGY BY PROVIDING AN ANALYSIS TOOL ALLOWING PROCESS, DEVICE, AND TEST ENGINEERS TO OPTIMIZE DEVICES FOR PERFORMANCE AND MANUFACTURABILITY THROUGH A QUANTITATIVE ASSESSMENT OF FACTORS AFFECTING PERFORMANCE OR UNIFORMITY.

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Topic#: 91-110 ID#: 9120180
Office: DSO
Contract #: DAAH0192CR038
PI: BARRY ARKLES

Title: BIOMIMETIC PROCESSING OF SILICATE STRUCTURES

Abstract: THIS PROPOSAL IS DIRECTED TOWARD THE PREPARATION OF *SOL-GEL DERIVED SILICATE* STRUCTURES BY BIOMIMETIC PROCESSES. ORGANOSILICON AND GERMANIUM PROBES WILL BE SYNTHESIZED AND THEIR EFFECTS ON REPRESENTATIVE SPECIES OF DIATOMS WILL BE SCREENED. DIATOMS PRODUCE AN ORDERED DEPOSITION OF AMORPHOUS SILICON DIOXIDE FROM SUPERSATURATED SILICATE SOLUTIONS. ORDERED DEPOSITION OF SILICON DIOXIDE IS A MAJOR OBJECTIVE OF SOL-GEL. THE RESULTS OF SCREENING STUDIES SHOULD INDICATE WHICH OF THE ALTERNATIVES FOR CONTROL OF SILICON DIOXIDE DEPOSITION IN VIVO ARE MOST ACCESSIBLE TO BIOMIMETIC SOL-GEL PROCESSING: 1. OBSERVATION OF COMPLEXES OF SILICIC ACID ANALOGS WITH SIMPLE MOLECULES, LEADING TO HIGH SOLUBILITY OF MONOMERIC OR OLIGOMERIC SILICATES ANALOGOUS TO DCCA (DRYING CONTROL CHEMICAL ADDITIVES) IN SOL-GEL. 2. INHIBITION AND POSSIBLY ISOLATION OF IONOPHORETIC SILICATE TRANSPORT COMPLEXES. 3. INHIBITION AND POSSIBLY ISOLATION OF PROTEINS OR POLYSACCHARIDES INVOLVED IN DEPOSITION OF SILICATES FROM SILICALEMMAS OR OTHER HIGHER ORDER DIATOM STRUCTURES. THERE IS A POSSIBILITY THAT ORGANOSILICON OR GERMANIUM COMPOUNDS COULD BE INCORPORATED INTO THE SILICATE STRUCTURES, YIELDING NEW MATERIALS BY BIOPROCESSING. THE FUTURE OBJECTIVE WOULD BE TO PURSUE THE MOST VIABLE OF THE ALTERNATIVES DEVELOPED BY THE INITIAL SCREENING: POSSIBLE UTILIZATION OF SMALL MOLECULES IDENTIFIED IN PHASE I OR SYNTHETIC ANALOGS DIRECTLY AS A DCCA ADDITIVES; ALTERNATELY, INFORMATION SUITABLE FOR DEVELOPMENT OF MARKERS FOR ISOLATION OR DEVELOPMENT OF GENETICALLY ENGINEERED POLYSILICATE SYNTHESIS MAY BE GENERATED. THE TWO MOST LIKELY FORMS OF INVENTION OR DISCOVERY FROM THIS PROPOSAL ARE EITHER A NON-BIOCHEMICAL SYSTEM FOR THE CONTROL OF SILICATE SYNTHESIS DEVELOPED FROM BIOLOGICAL DCCA'S OR A BIOCHEMICAL SYSTEM, PRESUMABLY PROTEIN MEDIATED SILICATE SYNTHESIS. THE UTILIZATION OF A BIOCHEMICAL SYSTEM WOULD IMPLY DEVELOPMENT OF GENETICALLY ENGINEERED PRODUCTION OF THE ACTIVE PROTEIN.

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Topic#: 91-125 ID#: 9121192
Office: LSO
Contract #: DAAH0192CR054
PI: MICHAEL RILEY

Title: METALLIC COMPOSITE ARMOR FOR LIGHT AND/OR ULTRALIGHT APPLICATIONS

Abstract: THE SELF PROPAGATING HIGH TEMPERATURE SYNTHESIS (SHS) REACTION PROCESS WILL BE STUDIED AS A MEANS OF SYNTHESIZING NEAR-NET-SHAPE TI6AL-4V AND 6061 AI ALLOY METAL MATRIX COMPOSITES (MMCS) INTO LOW COST FUNCTIONALLY GRADIENT BALLISTIC RESISTANT ALLOYS. A NOVEL MEANS OF INITIATING THE SHS REACTION HAS BEEN DEVELOPED TO SYNTHESIZE ALLOY COMPOSITES WITH LOW OXYGEN CONTAMINATION. THE COMPOSITION OF THE MATERIALS UNDER STUDY WILL BE VARIED BY THE IN SITU FORMATION OF SECOND PHASE PARTICLES (TIB2NBB2TINBBX), GRADIENT IN PERCENTAGE THROUGH THE MATERIAL. ONE SURFACE OF THE COMPOSITE ALLOY WILL BE 90% HIGH HARDNESS PHASE-10% METAL ALLOY; DECREASING CONCENTRATIONS OF HARD PARTICLES DISPERSED IN A ALLOY MATRIX WILL EXTEND TO THE ANTERIOR SURFACE WHICH WILL BE PURE TI-6AL-4V OR 6061 AL ALLOY. COMPOSITION AND MICROSTRUCTURE WILL BE OPTIMIZED FOR THE LIGHT AND ULTRALIGHT HIGH PERFORMANCE ARMOR MISSIONS. SCANNING ELECTRON MICROSCOPY (SEM) AND X-RAY DIFFRACTION WILL BE USED TO ANALYZE COMPOSITE STRUCTURE, PARTICLE/GRAIN SIZE AND THEIR DISTRIBUTION WITHIN THE OVERALL STRUCTURE OF THE MOST PROMISING FINAL PRODUCTS. AN IN DEPTH LITERATURE SEARCH WILL BE CONDUCTED FOCUSING ON INTERNATIONAL EFFORTS TO UTILIZE SHS SYNTHESIS OF HIGH TEMPERATURE STRUCTURAL MATERIALS. LOW COST NEAR-NET FABRICATION, NOVEL ALLOY DEVELOPMENT, SUPERIOR LIGHTWEIGHT BALLISTIC RESISTANT ALLOY COMPOSITES, DEMONSTRATION OF THE SYNTHESIS OF FUNCTIONALLY GRADIENT COMPOSITES FOR ARMOR APPLICATIONS. COMPENDIUM OF AVAILABLE SHS RELATED LITERATURE.

GEO-CENTERS, INC.
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Topic#: 91-004 ID#: 9110345
Office:
Contract #: DAAH0191CR227
PI: H. SMITH

Title: HIGH SENSITIVITY MAGNETIC SENSORS FOR REMOTE DETECTION OF GROUND VEHICLES

Abstract: GEO-CENTERS, INC. PROPOSES TO DESIGN A NOVEL SYSTEM OF DISTRIBUTED MAGNETIC FIELD SENSORS WHICH IS CAPABLE OF DETECTING AND LOCATING APPROACHING GROUND VEHICLES OR SMALL FERROUS OBJECTS. THE PROPOSED SYSTEM HAS THE UNIQUE ADVANTAGES OF ABITRARY DEPLOYMENT AND INTERCHANGEABLE SENSOR TYPES. THIS PHASE I SBIR PROGRAM WILL DETERMINE SYSTEM EFFECTIVENESS, ACCURACY, NOISE IMMUNITY, AND DEVELOPMENT COSTS OF AN ARRAY OF MAGNETIC FIELD SENSORS, SUCH AS THE SOLID-STATE CHIPMAG RECENTLY DEVELOPED BY GEO-CENTERS, INC. THE DESIGN DEFINITION WILL ANALYZE SENSOR PARAMETERS: SENSITIVITY, ACCURACY, SIGNAL BANDWIDTH, NOISE, POWER CONSUMPTION, SELF-SIGNATURE, WEIGHT, AND SIZE; AND ARRAY PARAMETERS: CONFIGURATION, NUMBER OF SENSORS, SENSOR DISTRIBUTION, POWER REQUIREMENTS, DATA TRANSMISSION METHODS, PROCESSING REQUIREMENTS, DATA REDUCTION ALGORITHMS, AND ARRAY CALIBRATION. DATA WILL BE COLLECTED IN FIELD DEMONSTRATIONS USING THE SELECTED SENSOR WITH AN AUTOCALIBRATION DIPOLE. POSTPROCESSING OF THE FIELD DATA WILL ESTABLISH EMPIRICAL VALUES OF CRITICAL PARAMETERS, SUCH AS: DETECTION DISTANCE, NOISE IMMUNITY, AND LOCATION ACCURACY. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE ULTIMATE GOALS OF THIS RESEARCH IS THE DEVELOPMENT AND DEMONSTRATION OF A MAGNETIC SENSOR SYSTEM WHICH CAN BE RAPIDLY DEPLOYED, THE FUNCTION OF WHICH IS TO DETECT AND ACCURATELY LOCATE APPROACHING FERROUS TARGETS, SUCH AS GROUND VEHICLES AND WEAPONS. THE PROPOSED SYSTEM HAS DIRECT APPLICATION IN PERIMETER SECURITY AND ACCESS CONTROL. THE PROGRAMMABILITY OF THE CONTROL UNIT AND THE CAPABILITY OF THE ARRAY TO ACCEPT DIFFERENT SENSOR TYPES HAS STRONG POTENTIAL APPLICATIONS IN COMMERCIAL AREAS WHERE DATA ACQUISITION OR LOGGING FROM DISTRIBUTED SENSORS IS INVOLVED, SUCH AS ENVIRONMENTAL MONITORING AND SEISMIC PROSPECTING.

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Phone: (617) 964-7070
Topic#: 91-134 ID#: 9120514
Office: LSO
Contract #: DAAH0192CR053
PI: ROBERT BRIANO
Title: EVALUATION OF VARIOUS MICRO-ACTUATOR TECHNIQUES FOR APPLICATION IN HIGH WORK OUTPUT DEFORMABLE SURFACES
Abstract: A USEFUL DEFORMABLE SURFACE WILL HAVE HIGH WORK/DENSITY RATIO REQUIREMENTS FOR IMPLEMENTATION IN CONTROL OF AERODYNAMIC SURFACES. GEO-CENTERS, INC. PROPOSES TO EVALUATE THREE APPROPRIATE TECHNOLOGIES WITH WHICH IT IS FAMILIAR TO DETERMINE THE OPTIMAL ONE FOR FUTURE PROOF-OF-PRINCIPLE DEMONSTRATION. THE THREE TECHNOLOGIES INCLUDE: PIEZOCERAMIC TRAVELING WAVE LINEAR ACTUATOR, PIEZOCERAMIC FLEXURAL RESONANCE DISK PNEUMATIC PUMP, AND THERMALLY AND ELECTRICALLY DRIVEN MECHANOCHEMICAL ACTUATOR GELS. GEO-CENTERS, INC. WILL DETERMINE THE OPTIMUM TECHNOLOGY FOR DEVELOPING A DEFORMABLE SURFACE CAPABLE OF HIGH WORK OUTPUT. IT WILL NOT ONLY HAVE APPLICATIONS IN AERODYNAMICS BUT ALSO IN ROBOTICS, PROCESS CONTROL AND MICROPOSITIONING.

GMA INDUSTRIES, INC.
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Phone: (415) 854-5678
Topic#: 91-042 ID#: 9110414
Office:
Contract #: DAAH0191CR296
PI: LATTIMER WRIGHT
Title: KNOWLEDGE-BASED SYSTEM INTEROPERABILITY STANDARD
Abstract: THE PROPOSED EFFORT INVOLVES THE DEVELOPMENT OF A KNOWLEDGE-BASED SYSTEM INTEROPERABILITY STANDARD. ACTIVITIES INVOLVED IN FULFILLING THE TECHNICAL OBJECTIVES INCLUDE THE ANALYSIS AND DEFINITION OF INTERFACES BETWEEN KNOWLEDGED BASED SYSTEMS, DATABASES, AND APPLICATION PROGRAMS, AND THE DESIGN AND SPECIFICATION OF A PROTOTYPE DEMONSTRATION SYSTEM FOR THE PURPOSE OF EVALUATING THE RESULTING STANDARD. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE PROPOSED PROJECT WILL FACILITATE THE USE AND INTEGRATION OF KNOWLEDGE BASED SYSTEMS WITH A VARIETY OF OTHER KNOWLEDGE BASED SYSTEMS, DATABASES, AND APPLICATION PROGRAMS. COMMERCIAL APPLICATIONS OF THIS WORK INCLUDE THE INCORPORATION OF THE RESULTING STANDARD INTO VARIOUS KNOWLEDGE-BASED COMMERCIAL PRODUCTS.

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Phone: (908) 257-9053
Topic#: 91-129 ID#: 9120078
Office: LSO
Contract #: DAAH0192CR120
PI: P. SEKHAR
Title: NOVEL PROCESSIBLE CONDUCTING POLYMER BASED VISIBLE AND IR TRANSMISSIVE OPTICAL WINDOW MATERIALS
Abstract: ADDRESSING THE NEED FOR HIGHLY CONDUCTIVE, IR AND VISIBLE TRANSPARENT OPTICAL WINDOW MATERIALS, THE PROPOSED WORK SEEKS TO USE NOVEL SOLUBLE CONDUCTING POLYMERS DEVELOPED IN THESE LABORATORIES IN UNRELATED WORK WHICH HAVE DEMONSTRATED HIGH TRANSPARENCY ACROSS THE VISIBLE AND MUCH OF THE IR REGIONS (DATA QUOTED HEREIN). THESE POLYMERS HAVE CONDUCTIVITIES UP TO 10 OHMS/SQUARE, THERMAL STABILITIES TO 350°C, THEIR REPROCESSED (RECAST) FILMS HAVE PROPERTIES IDENTICAL TO VIRGIN FILMS, AND MOST IMPORTANTLY, THEIR TRANSPARENCIES ARE CONTROLLABLE VIA DOPING LEVEL AND OTHER PARAMETERS. THE APPROACH PROPOSED WILL INVESTIGATE TWO METHODS OF USING THESE POLYMERS AS LAMINATES MOLDED UNDER HIGH PRESSURE, WHICH PRIOR UNRELATED WORK HAS CONFIRMED HAVE GOOD DURABILITY, AND AS CONDUCTIVE COATINGS ON TRANSPARENT SUBSTRATES. ADVANTAGES OVER COMPETING TECHNOLOGIES INCLUDE WIDE-BAND APPLICABILITY ACROSS THE VISIBLE AND IR REGIONS, PROCESSIBILITY AND MOULDABILITY INTO LARGE AREAS OR ODD SHAPES, AND LOW COST, WITH PRELIMINARY ESTIMATES FOR COATINGS BEING $0.75/SQUARE FOOT AND FOR MOLDED MATERIALS BEING

$5.00/SQUARE FOOT. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - IF THE TECHNOLOGY IS SUCCESSFUL, BESIDES THE PRESENT APPLICATIONS FOR CONDUCTIVE, IR AND VISIBLE TRANSMISSIVE MATERIALS, OTHER APPLICATIONS INCLUDE WHEREVER CONDUCTIVE COATINGS ARE NEEDED, E.G. RADAR SIGNATURE CONTROL, IR, VISIBLE EMISSIVITY AND SIGNATURE CONTROL, PHOTOCHROMIC DISPLAYS, ELECTRODE BATTERIES. SINCE THE NEW POLYMERS HAVE APPRECIABLE NONLINEAR OPTICAL EFFECTS, ELECTRO-OPTIC SWITCHES ARE ALSO AN APPLICATION.

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Topic#: 91-078 ID#: 9110630
Office:
Contract #: DAAH0191CR240
PI: ROBERT MEANS

Title: NEURAL NETWORK RETINAL MODEL REAL TIME IMPLEMENTATION

Abstract: HNC PROPOSES TO IMPLEMENT AND DEMONSTRATE A REALTIME NEURAL NETWORK MODEL OF THE RETINA FOR TARGET DETECTION AND TRACKING. THE ALGORITHM FOR THE NEURAL NETWORK PROCESSING WAS INVENTED AND INITIALLY DEMONSTRATED ON A SUN SPARC STATION TM AT LAWRENCE LIVERMORE NATIONAL LABORATORY WITH GOOD RESULTS. HNC PROPOSES TO USE THE LATEST VLSI NEURAL NETWORK HARDWARE TO DEMONSTRATE AN IMPROVED AND OPTIMIZED VERSION OF THE ALGORITHM FOR REAL TIME TARGET DETECTION AND TRACKING. THE REAL TIME ALGORITHM CAPABILITIES WILL BE ACHIEVED BY A NEW, HNC DESIGNED, IMAGE PROCESSING NEURAL NETWORK CHIP SET. THIS CHIP SET, CALLED THE VISION PROCESSOR (VIP)TM, WAS INITIALLY FUNDED ON A DARPA CONTRACT, AND IS BEING FABRICATED BY HNC AND A COMMERCIAL PARTNER. THE CHIP SET IS IMPLEMENTED AS A VME IMAGE COPROCESSOR FOR THE SUN WORKSTATION. THE OBJECTIVE OF PHASE I IS TO IMPLEMENT ON THE VIP COPROCESSOR HARDWARE THE NEURAL NETWORK ALGORITHM THAT PRESENTLY RUNS IN SOFTWARE ON THE SUN SPARC STATION. SIMULATIONS OF THE VIP CHIP SET HAVE SHOWN THAT IT CAN EXECUTE THE TRACKING ALGORITHM'S OPERATIONS OVER 1000 TIMES AS FAST AS THE SOFTWARE CAN EXECUTE THEM. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - IN PHASE II, HNC PLANS TO DEVELOP AND DELIVER A PROTOTYPE TRACKING SYSTEM FOR A SPECIFIC TRACKING DATA SENSOR FOUND IN A RADAR, OPTICAL, OR INFRARED DEFENSE SYSTEM. THE PROTOTYPE WILL BE ABLE TO TRACK MANY OBJECTS IN A CLUTTERED ENVIRONMENT IN REAL TIME. SINCE THE PROTOTYPE SYSTEM IS BASED ON A SMALL, LIGHTWEIGHT VLSI CHIP SET, IT CAN ALSO BE INTEGRATED INTO SMART WEAPONS FOR TARGET TRACKING AND RECOGNITION. THE RETINAL MODEL CAN BE EXPANDED IN THE FUTURE TO INCLUDE VISION FUNCTIONS OTHER THAN TRACKING, SUCH AS SEGMENTATION AND ATTENTION FOCUSING. THIS SYSTEM CAN SERVE AS THE BUILDING BLOCK OR MODULE IN A COMPLETE VISION SYSTEM FOR AUTONOMOUS VEHICLES OR ROBOTIC SYSTEMS.

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Topic#: 91-110 ID#: 9120726
Office: DSO
Contract #: DAAH0192CR102
PI: ROBERT HECHT-NIELSEN

Title: WHEEL OF FORTUNE

Abstract: VERY LOW COST (<$500) REAL-TIME MACHINE VISION SYSTEMS FOR OBJECT ACQUISITION, CLASSIFICATION, AND MEASUREMENT IN UNCONSTRAINED ENVIRONMENTS WILL, IN THE NEAR FUTURE, BE ESSENTIAL FOR APPLICATIONS SUCH AS AUTONOMOUS SYSTEMS (SELF-DIRECTED MUNITIONS, HOME CLEANING ROBOTS, AUTOMOBILE AUTOPILOTS, ETC.), SURVEILLANCE SYSTEMS (MILITARY SITE SECURITY, BORDER PATROL, LAW ENFORCEMENT, ETC.), AND INDUSTRIAL SYSTEMS (GENERAL-PURPOSE MECHANICAL ASSEMBLY SYSTEMS, MAIL HANDLING SYSTEMS, ETC.). NONETHELESS, THE ADVENT OF SUCH MACHINE VISION SYSTEMS CURRENTLY SEEMS TO MANY TO BE A DECADE OR MORE AWAY. THIS PROJECT BOLDLY ADDRESSES THIS MAJOR TECHNOLOGICAL SHORTFALL VIA A RADICALLY DIFFERENT APPROACH: THE DEVELOPMENT OF A VERY LOW COST VISION SYSTEM THAT EXPLOITS INSIGHTS GAINED FROM VISION NEUROSCIENCE. SPECIFICALLY, WE SHALL DEVELOP AN AGILE BINOCULAR EYEBALL/PROCESSOR SYSTEM WITH OBJECT ACQUISITION, OBJECT RECOGNITION, OBJECT MEASUREMENT, OBJECT TRACKING, AND

SENSOR MOTION DETERMINATION CAPABILITIES. THE EXPECTED HIGH OPERATIONAL PERFORMANCE OF THE SENSOR DERIVES FROM RECENT BREAKTHROUGH RESEARCH ON AUTONOMOUSLY MANEUVERED AGILE FOVEATED SENSORS. THE LOW COST OF THE SENSOR DERIVES FROM A RADICALLY NEW DESIGN APPROACH INVOLVING THE USE OF A SPINNING MECHANICAL WHEEL WHICH FUNCTIONS AS AN INCOHERENT SPATIAL LIGHT DIRECTOR AND COLOR FILTER. THE OUTPUT OF PHASES I AND II OF THIS PROJECT WILL BE A PREPRODUCTION PROTOTYPE SENSOR THAT WILL BE DEMONSTRATED IN A REALISTIC UNCONSTRAINED ENVIRONMENT. IN PHASE III WE ANTICIPATE DEVELOPING A PILOT PRODUCTION VERSION OF THIS SYSTEM TO BE SOLD TO THE UNITED STATES GOVERNMENT AND TO MANUFACTURERS OF ROBOTS, SURVEILLANCE EQUIPMENT, AND INDUSTRIAL INSPECTION SYSTEMS. AS EXPERIENCE IS GAINED BY OUR CUSTOMERS, THE SENSOR DESIGN(S) WILL EVOLVE INTO VERSIONS THAT ARE PRODUCED IN LARGE QUANTITIES.

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Topic#: 91-114 ID#: 9120392
Office: MTO
Contract #: DAAH0192CR119
PI: SERGEY RYLOV

Title: DESIGN STUDY OF SUPERCONDUCTING OVERSAMPLING FLUX-COUNTING A/D CONVERTERS USING RAPID SINGLE FLUX QUANTUM (RSFQ) LOGIC

Abstract: HYPRES PROPOSES A PROGRAM TO RESEARCH, DEVELOP, AND DEMONSTRATE FEASIBILITY OF A NEW FAMILY OF HIGH-PERFORMANCE SUPERCONDUCTING A/D CONVERTERS USING THE PRINCIPLES OF COUNTING SINGLE MAGNETIC FLUX QUANTA AND OVERSAMPLING; IT IS CAPABLE OF BOTH WIDE-BANDWIDTH AND HIGH ACCURACY OPERATION BY MAINTAINING UNIQUE BANDWIDTH-ACCURACY TRADEOFF RATIO OF 1.5 EFFECTIVE BITS (INSTEAD OF USUAL 1 BIT) PER FACTOR-OF-2 BANDWIDTH REDUCTION WHILE STARTING AS HIGH AS 1 BIT AT 20-50 GHZ BANDWIDTH (DEPENDING ON TECHNOLOGY LEVEL). THE PROPOSED ADC FAMILY IS EMPLOYING RECENTLY DEVELOPED RAPID SINGLE FLUX QUANTUM (RSFQ) LOGIC/ MEMORY ELEMENTS CAPABLE OF CLOCK FREQUENCIES IN EXCESS OF 100 GHZ. IN PHASE I WE INTEND TO COMPLETE THEORETICAL STUDY OF THIS ADC FAMILY AND TO DESIGN, FABRICATE AND DEMONSTRATE ITS KEY COMPONENTS OPERATING AT MULTI-GHZ CLOCK FREQUENCIES. IN PHASE II WE PLAN TO CONTINUE THIS WORK WITH THE AIM OF OBTAINING A WORKING PROTOTYPE OF OVERSAMPLING FLUX-COUNTING ADC DEMONSTRATING THE IMPROVED ACCURACY/BANDWIDTH TRADE-OFF RATIO MENTIONED ABOVE. THE PRINCIPAL BENEFITS ARE EXPECTED TO BE IN HIGH-SPEED REAL-TIME SIGNAL PROCESSING WHERE WIDE-BANDWIDTH AND/OR HIGH ACCURACY DIGITIZATION OF TRANSIENTS IS IMPERATIVE, SUCH AS RADAR, DIGITAL TV, ENCRYPTED COMMUNICATIONS, HIGH-SPEED ELECTRONICS INSTRUMENTATION, ELECTRONIC WARFARE SYSTEMS, ETC. COMBINATION OF THE FLUX COUNTING APPROACH WITH THE OVERSAMPLING TECHNIQUE WILL DRASTICALLY IMPROVE BOTH STATIC AND DYNAMIC ACCURACY OF A/D CONVERSION, LEADING TO CONVERTORS WITH PERFORMANCE TO 16 EFFECTIVE BITS AT BANDWIDTHS OF 20-50 MHZ.

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Topic#: 91-052 ID#: 9110117
Office:
Contract #: DAAH0191CR270
PI: BRUCE COTTMAN

Title: A FRAMEWORK FOR MECHANICAL ENGINEERING INFORMATION SYSTEMS

Abstract: DEVELOPMENT OF A CONCURRENT ENGINEERING INFORMATION SYSTEM PRESENTS SIGNIFICANT INTEGRATION AND CONCURRENCY CONTROL PROBLEMS. DIFFICULT INTEGRATION PROBLEMS ARE CAUSED BY THE WIDE RANGE OF APPLICATIONS REQUIRED BY A CE ENVIRONMENT. CE SYSTEMS INCLUDE: CAD/CAE SOFTWARE, DATABASE MANAGEMENT SYSTEMS (DBMS), PROJECT MANAGEMENT, AND EXOTIC SOFTWARE, SUCH AS EXPERT SYSTEMS. THIS PROPOSAL SPECIFIES A FRAMEWORK THAT PROVIDES BOTH A HIGH-LEVEL PRESENTATION AND DISTRIBUTED CONTROL MODELS FOR INTEGRATING HETEROGENEOUS MECHANICAL ENGINEERING APPLICATIONS AND TOOLS. THE DESIGN IS FOCUSED ON VERY LARGE DISTRIBUTED SYSTEMS WHERE DIFFERENT SUBSYSTEMS HAVE BEEN DEVELOPED BY DIFFERENT

ORGANIZATIONS HAVING DIFFERENT CONCEPTUAL FRAMEWORKS AND ADDRESSING DIFFERENT APPLICATION DOMAINS. THE BASIS OF THE FRAMEWORK INTERFACE WILL BE AN EXPLICIT OBJECT-ORIENTED REPRESENTATION OF BOTH THE DATA SPECIFICATIONS AND OPERATIONS OF THE DISTRIBUTED SYSTEM MODELS, SERVICES AND RESOURCES. THIS KEY INNOVATION IS A RECONFIGURABLE CONCURRENT ENGINEERING INFORMATION SYSTEM THAT IS SPECIFIED IN TERMS OF EXPLICIT, CHANGEABLE DESCRIPTIONS. ADDITIONAL KEY INNOVATIONS OF THIS PROPOSAL ARE: 1) ACCOMMODATION OF EXISTING CAD/CAE TOOLS; 2) DISTRIBUTED CONTROL MODELS: REDUCTION OF RESOURCE CONTENTION THROUGH GROUP BASED REPLICATED SERVICES; DISTRIBUTED, RELIABLE, GROUP BASED RECONFIGURATION AND RESOURCE ALLOCATION CONTROL MODELS; AND 3) UNIFORM SERVICE AND PROGRAMMING INTERFACES ACROSS HETEROGENEOUS ENVIRONMENTS.

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Topic#: 91-188 ID#: 9120134
Office: SSTO
Contract #: DAAH0192CR037
PI: BRUCE COTTMAN

Title: A FRAMEWORK FOR DISTRIBUTED PLANNING AND SCHEDULING SYSTEMS

Abstract: KNOWLEDGE-BASED PLANNING AND SCHEDULING (P&S) ENGINES REQUIRE THE INTEGRATION OF SEPARATE DATABASE MANAGEMENT SYSTEM (DBMS) FACILITIES IN ORDER TO MANAGE AND SHARE LARGE AMOUNTS OF SCHEDULING DATA AND KNOWLEDGE. PLANNING AND SCHEDULING ENGINES USE PARTICULARLY RICH DATA MODELS FOR THE REPRESENTATION OF ARBITRARILY COMPLEX INTERRELATIONSHIPS AND CONSTRAINTS. CONVENTIONAL DBMS TECHNOLOGIES, SUCH AS RELATIONAL AND FLAT-FILE, CAN NOT ADEQUATELY SUPPORT P&S DATA MODELS. IN THIS PROPOSAL, WE SUGGEST THAT OBJECT-ORIENTED DATABASE MANAGEMENT SYSTEMS (OODBMS) TECHNOLOGY IS MORE SUITABLE FOR P&S APPLICATIONS BECAUSE OF THE SEMANTIC RICHNESS OF OODBMS DATA MODELS. THE PHASE I EFFORT WILL FOCUS ON THE ISSUES AND PROBLEMS OF INTEGRATING TWO DIFFERENT EXISTING P&S SYSTEMS WITH A COMMERCIAL OODBMS AND A PUBLIC DOMAIN OODBMS. RESEARCH WILL BE FOCUSED ON REMOVING BARRIERS TO DISTRIBUTED P&S APPLICATION DEPLOYMENT. THE KEY INNOVATIVE FEATURES ARE: (1) AN OBJECT-ORIENTED DATA MODEL THAT IS UNIFORM ACROSS HETEROGENEOUS DEVELOPMENT LANGUAGES (C, LISP AND ADA) AND PROBLEM DOMAINS; (2) ALLOW EXISTING P&S APPLICATIONS TO BE MAINTAINED AND ENHANCED INDEPENDENTLY; (3) EXTEND USEFUL LIFETIME P&S APPLICATIONS BY ENABLING LOW COST INTEGRATION TO NEW TYPES OF INFORMATION MANAGEMENT SERVICES. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE PHASE I EFFORT WILL RESULT IN A FRAMEWORK FOR INTEGRATING PLANNING AND SCHEDULING APPLICATIONS WITH OBJECT-ORIENTED DATABASE MANAGEMENT SYSTEMS. MARKET SEGMENTS THAT REQUIRE SUCH CAPABILITIES INCLUDE OPERATION SUPPORT, COMMAND AND CONTROL, AND COMPUTER INTEGRATED ENGINEERING SYSTEMS. ALSO, THIS FRAMEWORK IS IDEAL FOR THE INTEGRATION OF EMERGING TECHNOLOGIES, SUCH AS IMAGE PROCESSING AND KNOWLEDGE-BASED SYSTEMS WITH EXISTING SYSTEMS.

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Topic#: 91-055 ID#: 9110184
Office:
Contract #: DAAH0191CR249
PI: JAMES LOCKER

Title: SUPERCONDUCTING MICROWAVE GATE

Abstract: IAP RESEARCH, INC. PROPOSES TO DEMONSTRATE A NOVEL TECHNOLOGY CONCEPT THAT WILL PROVIDE THE CAPABILITY TO BUILD AN ACTIVE MICROWAVE SWITCHING DEVICE USING CURRENTLY AVAILABLE HIGH TEMPERATURE SUPERCONDUCTING (HTSC) TECHNOLOGY. OUR CONCEPT PROMISES TO ENABLE HIGH EFFICIENCY, COMPACT, LIGHT WEIGHT, ADAPTABLE, VERY LOW NOISE RADAR AND COMMUNICATIONS DEVICES USING HTSC MATERIALS. OUR TECHNOLOGY PROVIDES THE NEEDED COMPONENT TO ENABLE THE FABRICATION OF COMPLETE RADAR RECEIVERS AND SIGNAL PROCESSORS USING HTSC MATERIALS. IN PRINCIPLE. IT SHOULD BE POSSIBLE TO FABRICATE THESE COMPLETE DEVICES ON A SINGLE HTSC WAFER. USING THIS TECHNOLOGY, IT COULD BE POSSIBLE TO FABRICATE A COMPLETE

RADAR TRANSMITTER, EXCEPT FOR THE MICROWAVE SOURCE, OUT OF HTSC MATERIALS. THIS CONCEPT WILL PROVIDE THE CAPABILITY TO TAKE EXISTING MICROWAVE SOURCES AND ADAPT THEM FOR MODERN MISSION REQUIREMENTS OF LOW PROBABILITY OF INTERCEPT SUPERCONDUCTING RADARS. IT COULD PERMIT VASTLY INCREASED TRANSMISSION BANDWIDTHS, FACILITATING SPREAD SPECTRUM TECHNIQUES, AND PERMITTING OUTPUT PULSE WIDTHS IN THE PICOSECOND RANGE. OVER A LONGER TERM, OUR TECHNOLOGY PROMISES TO ENABLE A COMPLETE LINE OF PRODUCTS AND DEVICES USING AC SWITCHING MECHANISMS, AND IMPLEMENTED USING HTSC MATERIALS. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - SUPERCONDUCTING RADARS, SUPERCONDUCTING GATES, ACTIVE CONTROL OF MICROWAVE, AND SIGNALS USING SUPERCONDUCTING COMPONENTS.

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Topic#: 91-069 ID#: 9110622
Office:
Contract #: DAAH0191CR177
PI: ELGIN EISSLER

Title: INTELLIGENT CONTROL OF BRIDGMAN CDZNTE CRYSTAL GROWTH

Abstract: LARGE, HIGH QUALITY CDZNTE SINGLE CRYSTALS ARE REQUIRED AS HGCDTE EPITAXIAL SUBSTRATES IN THE MANUFACTURE OF INFRARED FOCAL PLANE ARRAYS. BRIDGMAN GROWTH PROCESSES ARE CURRENTLY EMPLOYED TO PRODUCE MATERIALS WHICH MEET SOME APPLICATION REQUIREMENTS, BUT FALL SHORT IN MANY STATE-OF-THE-ART EPITAXIAL HGCDTE DEVICES. BRIDGMAN TECHNIQUES, BEING MELT PROCESSES, ARE STRONGLY INFLUENCED BY INTRICATE COUPLING BETWEEN HEAT AND MASS TRANSFER AND METAL FLOW. THE PROCESSES ARE CONTROLLED BY REGULATING SYSTEM GEOMETRIES, GROWTH RATES, AMBIENT ATMOSPHERES AND APPLIED THERMAL GRADIENTS. PROCESS INTRICACIES AND DEVIATIONS HAVE A PARTICULARLY LARGE EFFECT ON CDTE FAMILY CRYSTAL QUALITY DUE TO PARTICULARLY LARGE EFFECT ON CDTE FAMILY CRYSTAL QUALITY DUE TO THE LOW THERMAL CONDUCTIVITIES, STACKING FAULT ENERGIES AND YIELD STRENGTHS OF THESE MATERIALS. THIS PROJECT WILL STUDY THE APPLICATION OF INTELLIGENT PROCESSING OF MATERIALS (IPM) TECHNIQUES TO BRIDGMAN CDZNTE CRYSTAL GROWTH. THE OBJECTIVES OF HIGHER QUALITY, HIGHER YIELD AND LOWER COST WILL BE SOUGHT THROUGH THE APPLICATION OF ADVANCED SENSORS, INTELLIGENT ASSESSMENT AND ADAPTIVE CONTROL. IN PHASE I, AN ADVANCED TEMPERATURE SENSOR SYSTEM WILL BE DEVELOPED AND DEMONSTRATED AND THE CONCEPTUAL DESIGN OF AN IPM SYSTEM WILL BE PERFORMED. DURING PHASE II, IPM CONTROL OF METAL CONVECTION, LIQUID/SOLID INTERFACE SHAPE, GROWN-IN STRESS, DISLOCATION GENERATION, PRECIPITATE FORMATION AND/OR IMPURITY SEGREGATION WILL BE DEMONSTRATED. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - IPM ENHANCED PRODUCIBILITY OF CDZNTE SUBSTRATES WILL DRIVE HIGHER QUALITY, HIGHER YIELD HGCDTE EPITAXIAL MATERIALS LEADING TO HIGHER PERFORMANCE, LOWER COST IR FOCAL PLANE ARRAYS. THESE DEVICES WILL ENHANCE MANY DOD INFRARED SYSTEMS AND, IF COSTS ARE LOW ENOUGH, ENABLE COMMERCIAL IR.

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Topic#: 91-116 ID#: 9120907
Office: DSO
Contract #: DAAH0192CR078
PI: EDDY HOSE

Title: HIGH SPEED ELECTRO-OPTIC MODULATORS

Abstract: THE PROSPECTS OF EFFICIENT COUPLING INTO A SINGLE MODE OPTICAL FIBER, EASE OF FABRICATION AND FORMATION OF ARRAYS, AND SUITABILITY FOR OPTOELECTRONIC INTEGRATED CIRCUITS, HAVE LED TO RAPID ADVANCES IN THE DEVELOPMENT OF VERTICAL CAVITY SURFACE EMITTING LASERS (VCSEL). THEY HAVE THE POTENTIAL OF OPERATING AS SENSITIVE, LOW NOISE, LUMPED CONSTANT MODULATORS TO HIGH MILLIMETER-WAVE FREQUENCIES. WE PROPOSE TO EXPLORE AND DEMONSTRATE THE CAPABILITIES OF VERTICAL CAVITY STRUCTURES (VCS) DEVICES DEVELOPED FOR HIGH SPEED MODULATION OF OPTICAL CARRIERS. IN PHASE I WE WILL DEFINE MODULATOR CONCEPTS AND GENERATE A DEVELOPMENT ROADMAP FOR THEM, INCLUDING DEVICE FABRICATION AND TEST

PLANS. WE WILL TRANSLATE SYSTEM AND CIRCUIT APPLICATIONS INTO DEVICE REQUIREMENTS, DEVELOP DEVICE MODELS, ANALYZE THE PERFORMANCE OF CANDIDATE DESIGNS, AND DEFINE AN INGAASP/INP PROTOTYPE DEMONSTRATION DEVICE FOR THE 1.3-1.5 UM RANGE. IN PHASE II THE PROTOTYPE MODULATOR WILL BE FABRICATED USING THE METALORGANIC CHEMICAL VAPOR DEPOSITION (MOCVD) METHOD, AND ITS PERFORMANCE WILL BE EVALUATED AND COMPARED WITH THE THEORETICAL PREDICTIONS. THE DEVELOPMENT OF LOW COST, LARGE OPTICAL AND MODULATION BANDWIDTHS, LOW OPTICAL INSERTION LOSS, HIGH SENSITIVITY, LOW NOISE MODULATORS. POTENTIAL APPLICATIONS INCLUDE OPTICAL FIBER COMMUNICATIONS, OPTICAL RELAYING, ANTENNA BEAM FORMING, AND SIGNAL PROCESSING FOR MICROWAVE AND MILLIMETER-WAVE CARRIERS, AS WELL AS, OPTICAL COMPUTING AND SWITCHING.

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Topic#: 91-199
Office: CSTO
Contract #: DAAH0192CR058
PI: VASON SRINI

ID#: 9120843

Title: MCM DESIGN METHODOLOGY WITH MULTITECHNOLOGY FABRICATION TRADEOFFS

Abstract: THE FEASIBILITY OF EXTENDING DESIGN/SYNTHESIS TOOLS FOR SINGLE COMPONENTS TO ENABLE "SEAMLESS" BOARD AND SYSTEM LEVEL PARTITIONING DESIGN IS INVESTIGATED. THE DESIGN PROCESS BEGINS WITH A VHDL (E.G., ANSI?IEEE 1076) BEHAVIORAL DESCRIPTION FROM WHICH SYSTEM PARTITIONING ESTIMATES ARE GENERATED. THEN BOARD LEVEL LAYOUT IS UNDERTAKEN, THE DESIGN TOOLS BEING MINDFUL OF TESTING NEEDS (E.G., IEEE 1149 - BOUNDARY SCAN), SUBJECT TO THE SPECIFIC CHIPS TO BE USED. PACKAGING ALTERNATIVES INCLUDE DIRECT CHIP-ON-BOARD (COB), FLIP CHIP, AND TAB, AND ACCOUNT FOR ELECTRICAL THERMAL/VIBRATION ISSUES. THE PROPOSED SUITE OF TOOLS, BEGINNING WITH THIS COMPREHENSIVE DESIGN METHODOLOGY ARE IMPLEMENTED FOR A PARTICULAR CLASS OF COMPONENTS, NAMELY SEVERAL (E.G., 64) INTERCONNECTED, HIGH-SPEED (E.G., 67 MHZ) FIELD PROGRAMMABLE LOGIC ARRAYS (FPGAS) SUITABLE FOR BOTH GLUE LOGIC AND SUBSYSTEM LOGIC APPLICATIONS. THEN WE WILL EXTEND THIS METHODOLOGY TO INCORPORATE OTHER DIGITAL (E.G., CPU, RAM, ROM) AND ANALOG (E.G., A/D, D/A) CHIPS. ONE OF THE OUTPUTS OF THE PROPOSED TOOL KIT IS AN ASSEMBLY COMMAND SEQUENCE FILE FOR ICI'S UNIQUE PRECISION VISION-AIDED ROBOTIC (VAR) WORKCELL, WHICH CAN ASSEMBLE FINE PITCH (E.G., 6 MIL) COMPONENTS (E.G., FLIP CHIP, TAB) ON A VARIETY OF SUBSTRATES (E.G., KAPTON, SILICON, COPPER POLYAMIDE, CERAMIC). MOREOVER, THE AUTOMATED WORKCELL HAS THE POTENTIAL CAPABILITY OF PERFORMING SELECTIVE MECHANICAL (E.G., PULL) ELECTRICAL (E.G., RIC PROBE) AND VISUAL (E.G., SOLDER BRIDGING) TESTS ON THE ASSEMBLED MULTICHIP MODULES (MCM'S) DURING THE ASSEMBLY PROCESS. THUS THE PROPOSED TOOL KIT WILL PROVIDE A "DESIGN TO MANUFACTURING" CAPABILITY IN PHASE II. THE BENEFITS OF THIS FAMILY OF TOOLS WILL BE THE ABILITY TO RECURSIVELY EXERCISE THE TOOLS FOR AN AUGMENTED VHDL BEHAVIORAL DESCRIPTION AND EVENTUALLY CONVERGE ON A ROBUST HIGH PERFORMANCE ELECTRONIC SYSTEM DESIGN ACCOUNT FOR PERFORMANCE, MANUFACTURABILITY, AND COST TRADEOFFS ASSOCIATED WITH ALTERNATE IMPLEMENTATIONS OF MULTICHIP MODULE (MCM) BASED SYSTEMS, IN A SEAMLESS MANNER.

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Topic#: 91-241
Office: ASTO
Contract #: DAAH0192CR063
PI: JOSEPH GERARDI

ID#: 9120687

Title: ICE PROTECTION TECHNOLOGY DEMONSTRATION FOR UAVS

Abstract: OVER THE PAST FIVE YEARS, A RESEARCH CONSORTIUM SPONSORED BY THE NASA LEWIS RESEARCH CENTER HAS BEEN THE SOURCE OF THE DEVELOPMENT OF SEVERAL NEW ICE PROTECTION TECHNOLOGIES DIRECTLY APPLICABLE TO UNMANNED AUTONOMOUS VEHICLES (UAV'S). INNOVATIVE DYNAMICS (ID) HAS BEEN INVOLVED IN SEVERAL OF THESE PROGRAMS AND AS A RESULT HAS DEVELOPED AN ICE SENSOR BASED ON "SMART STRUCTURES" TECHNOLOGY. BY MONITORING THE VIBRATION

SIGNATURE OF A STRUCTURE, THE SYSTEM DETERMINES ICE THICKNESS AND DISTRIBUTIONS USING A NETWORK OF EMBEDDED SENSOR ARRAYS AND DISTRIBUTED PROCESSORS. PATTERN RECOGNITION TECHNIQUES ARE UTILIZED TO CLASSIFY THE SENSOR SIGNALS AND DETERMINE ICE BUILDUP AND ASSOCIATED AERODYNAMIC PENALTY. THE MEMORY OF THE SYSTEM IS FORMED THROUGH A LEARNING PROCESS IN WHICH A SYSTEMATIC SERIES OF EXPERIMENTS IS PRESENTED TO THE SYSTEM IN THE ICING WIND TUNNEL ENVIRONMENT. THE ICE DETECTION SYSTEM DESCRIBED HERE COULD BE USED IN CONJUNCTION WITH A VARIETY OF DEICING SYSTEM COMPONENTS TO PROVIDE AUTONOMOUS ICE PROTECTION CAPABILITY. DEICING TECHNOLOGIES TO BE EVALUATED INCLUDE ELECTRO-EXPULSIVE (EEDS), PNEUMATIC IMPULSE (PIIP) AND SHAPE MEMORY ALLOY (SMA) DEICERS. DURING THE PHASE I PROGRAM, ID WILL INTEGRATE THESE DEICING ACTUATORS WITH OUR ICE DETECTION SYSTEM FOR PERFORMANCE EVALUATION IN AN ICING CHAMBER. THE BEST OVERALL PERFORMER WILL BE DEVELOPED INTO AN INTEGRAL UAV STRUCTURE FOR ICING QUALIFICATION TESTING DURING THE PHASE II PROGRAM. THE PROPOSED AUTONOMOUS ICE PROTECTION SYSTEM WILL OFFER AN ALTERNATIVE TO CURRENT DEICING SYSTEMS USED ON COMMERCIAL AND MILITARY AIRCRAFT. FOR EXAMPLE, THIS SYSTEM CAN BE APPLIED TO ADVANCED COMMERCIAL TRANSPORTS WITH HIGH BYPASS AND TURBOPROP ENGINES WHERE ENGINE BLEED AIR IS NOT AVAILABLE.

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Topic#: 91-237 ID#: 9120439
Office: ASTO
Contract #: DAAH0192CR029
PI: RONALD GOUSE
Title: LOW-COST, MINIATURE TACTICAL JAMMERS
Abstract: THE PROGRAM OBJECTIVES OF LIGHTWEIGHT, DISPOSABILITY AND LOW-COST WILL BE ACHIEVED BY MINIMIZING THE NEED FOR A BATTERY POWER SOURCE FOR THE MINIATURE TACTICAL JAMMER. THE KEY FEATURES OF THE DISPOSABLE JAMMER ARE: SPACE DEPLOYED RANGE 1-2 KM FROM THE SURVEILLANCE RADAR. MINIATURE 6" X 3/4" CYLINDER. DISPENSED BY AIR VEHICLE, ARTILLERY SHE-11 OR GROUND PERSONNEL. GA AS LOGIC AND MMIC DEVICES. LONG SHELF LIFE. A UNIQUE FEATURE IS THE UTILIZATION OF THE RF ENERGY RECEIVED FROM THE SURVEILLANCE RADAR AS A SOURCE OF PRIME DC POWER FOR THE JAMMER, AS WELL AS A SIGNAL FOR COHERENT JAMMING. THE LIGHTWEIGHT JAMMER SHOULD PROVIDE A NEW TECHNIQUE FOR JAMMING AND RELIEVE MANNED AIRCRAFT FROM JAMMING SURVEILLANCE RADARS.

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Topic#: 91-020 ID#: 9110527
Office:
Contract #: DAAH0191CR310
PI: CHARLES EICHELBERGER
Title: HIGH PERFORMANCE, LOW COST, ADVANCED MULTICHIP MODULE TECHNOLOGY DEVELOPMENT
Abstract: ISA HAS DEVELOPED AN APPROACH FOR PACKAGING INTEGRATED CIRCUITS IN AN ADVANCED MULTICHIP MODULE (AMCM). THE APPROACH OFFERS UNSURPASSED THERMAL PERFORMANCE, ELECTRICAL PERFORMANCE, AND DENSITY WHILE SHOWING PROMISE OF LOW COST WHEN COMPARED TO SINGLE CHIP PACKAGE ASSEMBLIES OR OTHER MULTICHIP APPROACHES. THE PROPOSED EFFORT WILL DEMONSTRATE THE APPLICABILITY OF THE AMCM TECHNOLOGY TO BOTH DIGITAL AND ANALOG CIRCUITS. TO MEET THIS OBJECTIVE WORKING PROTOTYPE MODULE WILL BE DESIGNED AND FABRICATED. THE MODULE WILL INCLUDE A SIMPLE GAAS CIRCUIT AND SEVERAL INTERCONNECT CHARACTERIZATION STRUCTURES. THE TECHNOLOGY DEMONSTRATED IN THIS EFFORT IS AN INTERCONNECT-ON-TOP-OF-THE-CHIPS APPROACH. THIS APPROACH OFFERS SIGNIFICANT PERFORMANCE ADVANTAGES OVER CONVENTIONAL MULTICHIP MODULES WHERE THE CHIPS ARE MOUNTED AND INTERCONNECTED TO A MINIATURE CIRCUIT BOARD WITH WIRE BOND, TAB OR FLIP CHIP TECHNIQUES. THE ONLY OTHER "INTERCONNECT ON TOP OF THE CHIPS" APPROACH WAS DEVELOPED BY GE FOR RAPID PROTOTYPING IN AEROSPACE SYSTEMS. THE EFFORT PROPOSED HERE WILL PROVIDE SOMEWHAT IMPROVED PERFORMANCE OVER THAT APPROACH, BUT MORE IMPORTANTLY IS SPECIFICALLY DESIGNED TO MEET THE COST

OBJECTIVES OF HIGH VOLUME APPLICATIONS. THESE COST ADVANTAGES WILL BOTH DIRECTLY IMPACT DOD APPLICATIONS AND ESTABLISH A COMMERCIAL PRODUCT BASE THAT WILL FURTHER REDUCE COSTS FOR DOD APPLICATIONS. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - A SPECIFIC OBJECTIVE OF THE OVERALL PROGRAM IS TO DEVELOP A TECHNOLOGY AND IN PHASE III A HIGH VOLUME MANUFACTURING CAPABILITY WHICH PROVIDES THE REQUIRED HIGH PERFORMANCE FOR GOVERNMENT AND COMMERCIAL CUSTOMERS AT COSTS SIGNIFICANTLY BELOW ANY OTHER KNOWN APPROACH.

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Topic#: 91-181
Office: ESTO
Contract #: DAAH0192CR024
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ID#: 9120905

Title: MODELING, SIMULATION, AND CONTROL OF SEMICONDUCTOR FACTORIES

Abstract: THE OBJECTIVE OF THIS EFFORT IS TO DEVELOP A COMPREHENSIVE SOFTWARE TOOLKIT THAT CAN HELP A SEMICONDUCTOR WAFER FABRICATION FACILITY (WAFER FAB) ACHIEVE SIGNIFICANTLY HIGHER ASSET UTILIZATION AND THROUGHPUT COMBINED WITH REDUCED WORK-IN-PROGRESS, CYCLE TIMES AND TARDINESS. THE SOFTWARE TOOL WILL BE USED BY DESIGNERS OF FACTORIES TO EXPERIMENT WITH ALTERNATE CONFIGURATIONS AND SCHEDULING STRATEGIES AND BY OPERATORS OF FACTORIES TO GENERATE OPERATING SCHEDULES. EXISTING SIMULATION TOOLS DO AN ADEQUATE JOB OF EVALUATING ALTERNATE EQUIPMENT, PROCESS AND DEMAND CONDITIONS. THE PRINCIPLE DIFFICULTY THE USERS HAVE IS IN EXPERIMENTING WITH SCHEDULING LOGIC THAT IS DIFFERENT FROM DISPATCHING LOGIC. THE PROPOSED SOFTWARE WILL PROVIDE THE USER WITH FLEXIBILITY AND POWER TO EXPERIMENT WITH AND IMPLEMENT SCHEDULING LOGIC THAT HELPS MINIMIZE THE IMPACT OF KEY OBSTACLES TO PERFORMANCE. THE SOFTWARE TOOL WILL PROVIDE MODULES FOR LOAD PLANNING, LOT RELEASE CONTROL, SEQUENCING AND FACTORY SIMULATION. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE SOFTWARE RESULTING FROM THIS EFFORT WILL SIGNIFICANTLY IMPROVE THE COST EFFECTIVENESS OF SEMICONDUCTOR AND OTHER FACTORIES. THIS SOFTWARE WOULD BE ATTRACTIVE TO MOST MAJOR MANUFACTURING COMPANIES.

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Topic#: 91-050
Office:
Contract #: DAAH0191CR322
PI: LEONARD HAYNES

ID#: 9110445

Title: MODULAR OPEN ARCHITECTURE INTELLIGENT CONTROLLERS FOR GENERAL PURPOSE MACHINE TOOLS

Abstract: THE LOW END NGC IMPLEMENTATIONS SHOULD BE MORE COST EFFECTIVE THAN INTERNATIONAL COMPETITION, BUT IT IS THE HIGH END NGC CONTROLLERS WHERE NEW CAPABILITIES WILL RESULT. HIGH END NGC SYSTEMS SHOULD PROVIDE ACCURACY AND SURFACE FINISH NOT ACHIEVABLE WITHOUT NGC'S CAPABILITY TO INCORPORATE REAL-TIME CONTROL ENHANCEMENT SOFTWARE SUCH AS REAL-TIME ERROR COMPENSATION, REAL-TIME ACTIVE VIBRATION DAMPING, REAL-TIME CLOSED-LOOP PROCESS CONTROL, ETC. THIS PROPOSAL FOCUSES ON AN EARLY IMPLEMENTATION OF A HIGH-END NGC SYSTEM IMPLEMENTED ON THE PARALLEL INFERENCE MACHINE (PIM) DEVELOPED BY FLAVORS TECHNOLOGY. PIM HAS PROVEN ITSELF AS A CAPABLE HOST FOR INDUSTRIAL APPLICATIONS. IN ITS MAXIMUM CONFIGURATION, IT CONTAINS 128 MOTOROLA 68030 MICROPROCESSORS WITH A GIGABYTE OF MEMORY SO THAT NO FORSEEABLE NGC IMPLEMENTATION WILL BE TOO LARGE TO HOST ON THE PIM. THIS PROPOSAL DETAILS THE TECHNICAL ISSUES ASSOCIATED WITH IMPLEMENTING NGC ON THE PIM. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE GOAL OF THE NCG PROGRAM IS TO REVITALIZE THE U.S. MACHINE TOOL INDUSTRY, PROVIDE U.S. MANUFACTURERS OF MACHINED PARTS WITH TECHNOLOGY WHICH WILL INCREASE THE QUALITY OF THEIR PRODUCTS AND DECREASE THEIR COST, AND FINALLY GIVE THE U.S. MILITARY A QUALITATIVE INCREASE IN CURRENT MANUFACTURING CAPABILITIES. IMPLEMENTING NGC ON THE PIM WILL PROVIDE AN EXTENSIBLE HOST WHICH CAN MEET ANY FORSEEABLE APPLICATION, AND WHICH IS ALREADY CONFIGURED AND MARKETED AS A COMPUTER

FOR INDUSTRIAL APPLICATIONS.

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Topic#: 91-099 ID#: 9121123
Office: DSO
Contract #: DAAH0192CR007
PI: JOAN CARTIER

Title: CERAMIC SHIELDS FOR SATELLITE PROTECTION AGAINST HYPERVELOCITY IMPACT

Abstract: IMPROVED SPACECRAFT SHIELDING CAN BE REALIZED THROUGH CERAMIC AND ADVANCED ARMOR TECHNOLOGY TRANSFER FROM MILITARY RESEARCH AND DEVELOPMENT PROGRAMS. A SIGNIFICANT IMPROVEMENT IN THE MASS EFFICIENCY, THE EFFECTIVENESS AND THE COST BENEFIT OF SPACECRAFT SHIELDING WILL RESULT. OUR MATERIAL SELECTION, DESIGN AND OPTIMIZATION PROGRAM WILL FURTHER THE STATE OF THE ART IN ADVANCED SPACECRAFT ARMORS. INTERFEROMETRICS WILL DEMONSTRATE THE EFFECTIVENESS OF A NEW CERAMIC SHIELD INCORPORATING ADVANCED TECHNOLOGIES. THE CERAMIC SHIELD CONCEPTS ARE DESIGNED TO MAXIMIZE THE DISPERSION OF PROJECTILE MOMENTUM AND ENERGY. OTHER MEASURES OF EFFECTIVENESS INCLUDE TOLERANCE FOR THE EXTREME CONDITIONS OF PRESSURE AND TEMPERATURE CYCLING DURING LAUNCH AND IN ORBIT. PHASE I WILL YIELD A SHORT LIST OF CANDIDATE CERAMIC COMPOSITE SHIELD(S) AND AN ANALYTICAL MODEL ADAPTED TO ESTIMATE SHIELD EFFECTIVENESS. THE PHASE I SHIELDING DESIGN(S) WILL BE DEMONSTRATED AT THE SOUTHWEST RESEARCH INSTITUTE. TWO STAGE LIGHT GAS GUNS WILL ACCELERATE 1 TO 2 GRAM PROJECTILES TO TEST VELOCITIES OF 9 KM/S. SCALING TECHNIQUES WILL BE EVALUATED AND ADAPTED TO VALIDATE SHIELD RESPONSES. THE FINAL DESIGNS TO MEET EVOLVING REQUIREMENTS. THE PROPOSED SHIELD DESIGN TECHNIQUES REPRESENT AN APPROACH TO INCREASING SATELLITE PROTECTION WITH A CLEAR APPRECIATION OF COST AND WEIGHT CONSTRAINTS. THESE CERAMIC SHIELDS WILL PROVIDE ENHANCED PROTECTION AGAINST ARTIFICIAL DEBRIS AND ASAT WEAPON ATTACK. LIGHT WEIGHT ARMORS DESIGNED THROUGH THIS PROGRAM MAY ALSO FIND USE IN GROUND BASED APPLICATIONS.

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Topic#: 91-020 ID#: 9110129
Office:
Contract #: DAAH0191CR229
PI: PHILIP RIMA

Title: ADVANCED SILICON-ON-SILICON MULTICHIP MODULE DEVELOPMENT FOR AUTOMATED PRODUCTION.

Abstract: IMI PROPOSES TO UTILIZE ITS RECENT SUCCESSFUL PACKAGING RESEARCH IN MULTICHIP SILICON-ON-SILICON ASSEMBLIES TO DEVELOP A HIGH DENSITY, HIGH PERFORMANCE DESIGN FOR LOW COAST DIGITAL AND ANALOG MODULES. A CIRCUITED SILICON WAFER WILL BE UTILIZED AS A SUBSTRATE ON WHICH TO MOUNT FOUR OR MORE SILICON DEVICES. TAPE AUTOMATED BONDING (TAB) WILL BE UTILIZED AS THE INTERCONNECTION TECHNOLOGY BECAUSE OF ITS SUPERIOR THERMAL AND PERFORMANCE CHARACTERISTICS, AS WELL AS ITS ABILITY TO ACCOMMODATE 4 MIL PITCH BONDS, BOTH INNER AND OUTER LEAD. THE SILICON WAFER WILL HAVE 2 MIL2 GOLD BUMPS ELECTROPLATED ON THE PADS OF THE OLB FOOTPRINT. EACH CHIP WILL BE EXCISED FROM ITS TAB PATTERN AND MOUNTED TOP SIDE DOWN (FLIP TAB), WITH A SPACER MOUNTED ON THE TOP SURFACE TO: A) MAINTAIN THE POSITION OF TAB LEADS ON 4 MIL PITCH WHEN THEY ARE EXCISED, AND B) PROVIDE THE NECESSARY SPACING OF THE TAB LEADS ABOVE THE HEIGHT OF THE BUMPS TO ALLOW PATTERN RECOGNITION AND THE PRECISE POSITIONING REQUIRED FOR OUTER LEAD BONDING. ALONG WITH THE PERFORMANCE/COST TRADEOFFS, AUTOMATION FOR PRODUCTION PROCESSES WILL BE DEFINED IN PHASE I, AND DEVELOPED IN PHASE II. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - SUCCESSFUL COMPLETION OF THIS PROJECT WILL PROVIDE ECONOMICAL OPTIONS FOR PACKAGING ENGINEERS INVOLVED IN LEADING EDGE HIGH DENSITY, HIGH PERFORMANCE REQUIREMENTS, BOTH DIGITAL AND ANALOG. AUTOMATION OF TAB INTERCONNECTED MULTICHIP SILICON-ON-SILICON MODULES WILL RESULT IN HIGH RELIABILITY AND ATTRACTIVE PRODUCTION YIELDS, ALONG WITH CIRCUIT PERFORMANCE NOT POSSIBLE WITH WIRE BONDING.

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Topic#: 91-211 ID#: 9120604
Office: SSTO
Contract #: DAAH0192CR118
PI: RAMON ACOSTA
Title: DOMAIN SPECIFIC SOFTWARE PROCESS AUTOMATION TECHNOLOGY
Abstract: THIS PROPOSAL OUTLINES A FIRST-PHASE PLAN FOR CONSTRUCTING AN ENVIRONMENT TO DESCRIBE, PROTOTYPE, AND MANAGE SOFTWARE DEVELOPMENT PROCESSES. KEY TOOLS OF THIS ENVIRONMENT INCLUDE SEMANTICALLY RICH GRAPHICAL EDITORS TO DESCRIBE PROCESSES AND AN INTERPRETER FOR PROCESS SIMULATION AND INTERACTIVE EVALUATION OF SCHEDULING AND RESOURCE ALLOCATION AGAINST THE MODEL. THE ENVIRONMENT WILL BE BUILT ON PROTO+, A PROGRAMMING ENVIRONMENT BEING DEVELOPED AT ISSI WHICH IS BASED ON A HIERARCHICAL DATAFLOW LANGUAGE FOR PROTOTYPING DESIGNS. THE GOAL IS TO ENABLE A PROCESS ENGINEER OR PROGRAM MANAGER TO CONDUCT FEASIBILITY STUDIES IN SPECIFICATION, ADAPTATION, AND TAILORING OF PROCESSES TO SPECIFIC SOFTWARE DESIGN AND DEVELOPMENT ACTIVITIES. THEREFORE, WE BUILD THE ENVIRONMENT ON A CONCEPTUAL FRAMEWORK OF THREE INTERDEPENDENT VIEWS OF A PROCESS - ACTIVITY, COMMUNICATION, AND INFRASTRUCTURE (YEH ET AL., 1991). IN HARNESSING THESE PERSPECTIVES, WE ARE ABLE TO PROVIDE MANAGERS WITH ADDITIONAL HANDLES TO TACKLE THE COMPLEXITY OF SYSTEM DEVELOPMENT EFFORTS. A UNIQUE FEATURE OF THE PROPOSED PROGRAM THAT WILL ENABLE REACHING THIS GOAL IS THAT, IN ADDITION TO PROVIDING TOOLS FOR PROCESS DESCRIPTION, THE ENVIRONMENT WILL EMBODY FACILITIES FOR PROCESS SIMULATION AND ANALYSIS. USING PROCESSES SIMULATION, MANAGERS ARE ABLE TO ANSWER MANY "WHAT-IF" QUESTIONS BEFORE ENACTING THE PROCESS OR CHANGES TO THE PROCESS. THE R & D DESCRIBED HEREIN WILL SEEK TO DEFINE A VISUAL LANGUAGE FOR DESCRIBING AND SIMULATING THE SOFTWARE DEVELOPMENT PROCESS. THE ANTICIPATED RESULTS WILL PROVIDE DEVELOPERS WITH THE TOOLS FOR IMPROVING THEIR PROCESS. POTENTIAL COMMERCIAL APPLICATIONS INCLUDE INTERACTIVE PROCESS EDITORS AND PROCESS SIMULATORS.

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Topic#: 91-238 ID#: 9120444
Office: ASTO
Contract #: DAAH0192CR134
PI: BULENT BASOL
Title: DEVELOPMENT OF PROCESSES FOR FLEXIBLE, LIGHT-WEIGHT PV MODULES
Abstract: THE AIM OF THE PROPOSED PROJECT IS TO DEVELOP MONOLITHICALLY INTEGRATED CUINSE2 PV MODULES ON LIGHT-WEIGHT, FLEXIBLE AND INSULATING FOIL SUBSTRATES. THE PHASE I OF THE WORK WILL CONCENTRATE ON THE DEVELOPMENT OF THE INSULATING FOIL SUBSTRATES AND THE DEMONSTRATION OF MONOLITHIC INTEGRATION OF CUINSE2 CELLS ON THESE SUBSTRATES. IF SUCCESSFUL, THIS PROJECT WILL LEAD TO THE FABRICATION OF HIGH EFFICIENCY THIN FILM CUINSE2 PV MODULES ON FLEXIBLE SUBSTRATES. SUCH MODULES ARE NEEDED FOR MANY SPACE POWER APPLICATIONS.

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Topic#: 91-232 ID#: 9121069
Office: UWO
Contract #: DAAH0192CR025
PI: JAMES CASTRACANE
Title: ADVANCED INTENSIFIED HIGH DENSITY CCD ARRAYS
Abstract: IN A WIDE VARIETY OF MILITARY MISSIONS, THE DETECTION AND IMAGING OF EXTREMELY LOW LEVELS OF LIGHT IS NECESSARY. PRESENT DAY SYSTEMS INCORPORATE HIGH DENSITY CHARGE COUPLED DEVICES (CCD) WITH PIXEL SIZES AS SMALL AS 9 X 9 MICRONS. FOR EXAMPLE, THESE DETECTORS FORM THE HEART OF SOME LASER RANGING/TRACKING SYSTEMS AND ARE INVALUABLE BECAUSE OF THEIR SHORT RISE TIMES AND HIGH SENSITIVITY. HOWEVER, THE INCLUSION OF A LIGHT AMPLIFICATION STAGE BEFORE THE CCD CAN EXTEND THEIR LOW LEVEL RESPONSE RANGE SIGNIFICANTLY. A SUITABLE CHOICE

IS THE MICROCHANNEL PLATE (MCP). HOWEVER, THE CONVENTIONAL OPTICAL FIBER BASED CONSTRUCTION OF THE PLATES CAN BE THE LIMITING FACTOR BECAUSE OF THE LARGE PORE SIZE AND COMPONENT SPACING IN TYPICAL INTENSIFIER ARCHITECTURE. ALTERNATE ARCHITECTURE AND INCORPORATION OF SMALL PORE MCPS AND FIBER INTERFACES CAN LEAD TO A SIGNIFICANT IMPROVEMENT. THE PROPOSED PHASE I EFFORT WILL OPTIMIZE THE COUPLING OF AN MCP TO A CCD TO ACHIEVE HIGH SPATIAL RESOLUTION AND INCLUDE AN IN-DEPTH ANALYSIS TO MODEL THE INCREASE IN PERFORMANCE/COST RATIO EXPECTED FROM THIS COMPOUND SYSTEM. THIS STUDY WILL SERVE AS A FOUNDATION FOR IMPLEMENTATION AND TESTING OF THE DETECTOR SYSTEM IN PHASE II. THE DEVELOPMENT OF AN IMPROVED DETECTOR SYSTEM BASED ON THE COMBINATION OF CCDS AND MCPS WILL HAVE AN IMMEDIATE IMPACT IN A WIDE VARIETY OF RESEARCH AND COMMERCIAL APPLICATIONS. REMOTE SENSING, LOW LIGHT LEVEL IMAGE FORMATION AND SPECTROSCOPY ARE SEVERAL EXAMPLES OF DIRECT COMMERCIAL APPLICATIONS. THE COMPOUND DETECTOR COULD BE MARKETED AS A SEPARATE UNIT OR BE INCORPORATED INTO VARIOUS OPTICAL SYSTEMS.

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Topic#: 91-111 ID#: 9120343
Office: DSO
Contract #: DAAH0192CR100
PI: MANDAR SUNTHANKAR

Title: PLASMA ENHANCED VAPOR PLATING AS AN ALTERNATIVE TO ELECTROPLATING

Abstract: HEAVY METALS SUCH AS ZINC, CADMIUM OR CHROMIUM ARE ELECTROPLATED IN 5,300 FACILITIES ACROSS THE U.S. DURING THE PAST TWO DECADES, CONSIDERABLE RESEARCH HAS BEEN CONDUCTED TO REDUCE HAZARDOUS WASTE AND MINIMIZE OCCUPATIONAL HAZARDS IN THESE ELECTROPLATING OPERATIONS. HOWEVER, ECONOMICAL ELIMINATION OF TOXIC WASTE OR SLUDGE HAS NOT BEEN REPORTED. IN PURSUIT OF A SOLUTION TO THE ENVIRONMENTAL ISSUES RELATED TO ELECTROPLATING, A NOVEL PLASMA ENHANCED VAPOR PLATING (DRY PLATING) CONCEPT WAS DEVELOPED IN THE LABORATORY. IN ADDITION TO COMPETITIVE DEPOSITION RATES, THE FEASIBILITY OF ELIMINATING TOXIC CHEMICAL DISCHARGE AND SLUDGE IS DEMONSTRATED USING IN-SITU METAL RECLAIM. HOWEVER, AN UNDERSTANDING OF THE EFFECT OF PROCESS VARIABLES ON THE UNIFORMITY OF DRY PLATING ON COMPLEX SHAPES IS REQUIRED IN APPLIED FIELDS. A SYSTEMATIC RESEARCH USING STATISTICAL DESIGN METHODS HAS BEEN PROPOSED IN THE PHASE I TO DEVELOP THIS UNDERSTANDING. THE PROPOSED RESEARCH COULD LEAD TO AN ENVIRONMENTALLY BENIGN PLATING PROCESS AS AN ALTERNATIVE TO TOXIC LIQUID ELECTROPLATING. HEAVY METAL ELECTROPLATING IS WIDELY USED IN THE DEFENSE, AEROSPACE AND AUTOMOBILE INDUSTRIES. THE DRY PLATING METHOD WOULD BE ENVIRONMENTALLY SAFER AND ECONOMICAL FOR PLATING HEAVY METALS AND ALLOYS. IN ADDITION, THIS PROCESS WOULD ELIMINATE HYDROGEN EMBRITTLEMENT OF HIGH STRENGTH STEELS WHICH ARE USED IN CRITICAL DEFENSE SYSTEMS.

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Topic#: 91-036 ID#: 9110444
Office:
Contract #: DAAH0191CR300
PI: JOHN GRANATA

Title: A TENSOR PRODUCT COMPILER FOR SCALABLE PARALLEL COMPUTERS

Abstract: THE OBJECTIVE OF THIS WORK IS TO DEVELOP A TENSOR PRODUCT COMPILER THAT CAN PARSE TENSOR PRODUCT FORMULATIONS INTO WORKING CODE FOR SCALABLE PARALLEL PROCESSORS. THE TENSOR PRODUCT COMPILER WILL USE MATHEMATICAL TRANSFORM RULES TO OPTIMIZE CODE FOR SUCH PARAMETERS AS NUMBER OF PROCESSORS, THE ARCHITECTURE OF THE NODE PROCESSORS, THE RELATIONSHIP BETWEEN LOCAL AND GLOBAL MEMORY, AND LATENCY AND BANDWIDTH OF INTERPROCESSOR COMMUNICATION. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE TENSOR PRODUCT COMPILER WILL USE MATHEMATICAL TRANSFORM RULES WHEN OPTIMIZING CODE, THUS MAKING THESE COMPUTERS MUCH EASIER TO PROGRAM. AS THESE DIFFICULTIES ARE RESOLVED, SCALABLE MULTI-PROCESSORS SUCH AS THESE WILL BECOME VIABLE FOR MAINSTREAM

BUSINESS COMPUTING.

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Topic#: 91-113 ID#: 9120669
Office: MTO
Contract #: DAAH0192CR152
PI: JOHN JAMESON

Title: ADVANCED FORCE CONTROL OF ELECTRIC MANIPULATORS WITH ADAPTIVE CRITIC NETWORKS

Abstract: RESPONSIVE AND SENSITIVE FORCE CONTROL IS ESSENTIAL FOR SOPHISTICATED ROBOT TASKS SUCH AS ASSEMBLY AND FINE MANIPULATION. HOWEVER, THIS KIND OF CONTROL IS VERY DIFFICULT FOR MANIPULATORS DRIVEN BY ELECTRIC MOTORS WITH GEARED TRANSMISSIONS, PRIMARILY DUE TO FRICTION IN THE DRIVE TRAIN. YET THESE TYPES OF MECHANICAL SYSTEMS ARE OFTEN THE MOST PRACTICAL FOR MANY APPLICATIONS. TWO PRIMARY TYPES OF CONTROL STRATEGIES HAVE BEEN USED TO DATE FOR FORCE CONTROL WITH THESE KINDS OF SYSTEMS. ONE USES THE FORCE ERROR TO ADJUST THE TORQUE OF THE DRIVE MOTOR. THE OTHER UTILIZES FORCE FEEDBACK TO COMMAND MOTOR POSITIONS, RELYING ON COMPLIANCE IN THE SYSTEM FOR TRANSLATING POSITION TO FORCE. THE FORMER APPROACH TYPICALLY RESULTS IN SLUGGISH, NOISY CONTROL AND THE LATTER APPROACH TYPICALLY EXHIBITS POOR BANDWIDTH. NEITHER APPROACH ADEQUATELY ADDRESSES MANIPULATORS WHICH ARE MODERATELY BACK-DRIVABLE. WE PROPOSE AN ADAPTIVE FORCE CONTROL SYSTEM BASED ON THE "BACK PROPAGATED ADAPTIVE CRITIC" ARCHITECTURE, WHICH UTILIZES PRINCIPLES FROM DYNAMIC PROGRAMMING AND NEURAL NETWORKS TO ACHIEVE REAL-TIME ADAPTATION. THIS APPROACH REQUIRES FEW ASSUMPTIONS ABOUT PLANT DYNAMICS, AND A WIDE VARIETY OF SENSOR INPUTS CAN EASILY BE INCORPORATED. FURTHERMORE, EFFECTS WHICH DEPEND ON PAST AS WELL AS CURRENT STATES, SUCH AS BACKLASH, CAN ALSO BE ACCOMMODATED. HIGHER PERFORMANCE FORCE CONTROL FOR COMMON ELECTRIC MANIPULATORS (AND HANDS/ GRIPPERS) CAN SIGNIFICANTLY ENHANCE THE USE OF THESE DEVICES IN AUTOMATION AND TELEOPERATION. THE GENERAL ADAPTIVE CONTROL APPROACH COULD ALSO BE APPLIED TO MANY DIFFICULT CONTROL PROBLEMS IN THE GOVERNMENT AND INDUSTRY.

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Topic#: 91-095 ID#: 9120945
Office: DSO
Contract #: DAAH0192CR009
PI: B. HALPERN

Title: FLUX CONTROL IN JET VAPOR DEPOSITION VIA ATOMIC ABSORPTION SPECTROSCOPY

Abstract: JET VAPOR DEPOSITION (JVD) USES SONIC GAS JETS IN "LOW VACUUM" IN A NOVEL APPROACH TO THIN FILM DEPOSITION. IT IS RAPIDLY APPROACHING COMMERCIAL PRODUCTION CAPABILITY IN WHICH REAL TIME MONITORING AND CONTROL OF DEPOSITION RATES WILL BE ESSENTIAL. JVD IS PARTICULARLY POWERFUL FOR DEPOSITION OF MULTICOMPONENT FILMS SUCH AS PZT AND RELATED FERROELECTRICS, FOR WHICH CONTROL OF INDIVIDUAL METAL FLUXES IS MOST VALUABLE. ACCORDINGLY, WE PROPOSE IN PHASE I TO EQUIP OUR JVD APPARATUS WITH A SENSITIVE, RELIABLE AND FAST OPTICAL TECHNIQUE, ATOMIC ABSORPTION, IN ORDER TO MONITOR GAS PHASE METAL ATOM CONCENTRATIONS IN THE EMERGING JET. IN OUR "LOW VACUUM" JETS, THIS IS EQUIVALENT TO A FLUX MEASUREMENT AND RELATES DIRECTLY TO DEPOSITION RATE. THE ABSORBANCE WILL BE MEASURED VIA GAS SHIELDED OPTICAL FIBER BUNDLES POSITIONED ON OPPOSITE SIDES OF THE JET. OUR GOAL IS TO USE THE INSTANTANEOUS VALUES OF ABSORBANCE AS AN INPUT FOR REAL TIME FEEDBACK CONTROL OF JET SOURCE CONDITIONS AND HENCE DEPOSITION RATES. IN PHASE I WE WILL DEMONSTRATE THE FEASIBILITY OF USING ATOMIC ABSORPTION TO TRACK METAL ATOM CONCENTRATIONS IN THE EMERGING JETS FOR THE SELECTED TEST CASES CU, BA, Y, TI AND AU. THESE TEST CASES ARE CONVENIENT FOR EXPERIMENTATION AND INCLUDE ELEMENTS OF IMPORTANT MULTICOMPONENT FILMS SUCH AS FERROELECTRICS AND HIGH T SUPERCONDUCTORS. THE MAIN BENEFIT WILL BE A GENERAL MEANS OF CONTROLLING DEPOSITION RATES IN JVD BY NONINVASIVE OPTICAL MEASUREMENT. THIS WILL MAKE POSSIBLE DEPOSITION OF IMPORTANT MULTICOMPONENT FILMS, E.G. FERROELECTRICS AND HIGH T SUPERCONDUCTORS, WITH MORE ACCURATELY CONTROLLED COMPOSITIONS. THESE MATERIALS HAVE

COMMERCIAL VALUE AND ARE OF INTEREST TO THE FEDERAL GOVERNMENT.

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Topic#: 91-111 ID#: 9120153
Office: DSO
Contract #: DAAH0192CR145
PI: JOHN BAYLESS
Title: DEVELOPMENT OF THE RADCOAT PROCESS FOR THE APPLICATION OF SOLVENT-FREE COATINGS
Abstract: THERE ARE SEVERE CONCERNS AND INCREASING RESTRICTIONS REGARDING THE CONTENT OF VOLATILE ORGANIC COMPOUNDS (VOCS) IN CONVENTIONAL SOLVENT-BASED COATINGS. EXISTING APPROACHES FOR REDUCING VOC EMISSIONS, SUCH AS THE USE OF CUT-BACK SOLVENT TECHNOLOGY AND HIGH TEMPERATURE COATING PROCESSES, HAVE LIMITATIONS AND PROBLEMS. THUS, IT IS VERY IMPORTANT TO DEVELOP NEW COATING PROCESSES WHICH TOTALLY ELIMINATE THE NEED FOR VOCS. WE PROPOSE TO DEVELOP SUCH A PROCESS, TERMED THE RADCOAT PROCESS, WHICH USES ULTRAVIOLET (UV) OR ELECTRON BEAM (EB) RADIATION TO RAPIDLY POLYMERIZE SOLVENT-FREE COATINGS OF MONOMER/OLIGOMER MATERIALS (LIQUID ORGANIC MATERIALS OF LOW MOLECULAR WEIGHT) AS THEY ARE APPLIED. MANY RADIATION CURABLE COMPOUNDS HAVE BEEN DEVELOPED RECENTLY WHICH ARE NOW BEING USED IN INDUSTRY AS WEAR-RESISTANT COATINGS ON FLAT-SHEET MATERIALS. THE OVERALL OBJECTIVE OF THE RADCOAT PROJECT IS TO DEVELOP A NEW AND INNOVATIVE PROCESS, WHICH USES NO VOCS, FOR APPLYING COATINGS TO CONTOURED SURFACES SUCH AS ENCOUNTERED WITH AIRCRAFT AND OTHER MILITARY EQUIPMENT. TO ACCOMPLISH THIS, THE FOLLOWING PHASE I TASKS WILL BE UNDERTAKEN: (1) PERFORM TRADE-OFF STUDIES TO COMPARE UV AND EB APPROACHES AND TO SELECT THE ONE BEST SUITED FOR THE RADCOAT PROCESS; (2) DESIGN AND CONSTRUCT A SMALL-SCALE, PROOF-OF-PRINCIPLE EXPERIMENT TO CHARACTERIZE THE PROCESS; (3) PERFORM EXPERIMENTS TO DEMONSTRATE THE EFFICACY OF THE RADCOAT CONCEPT ON SAMPLE AIRCRAFT SUBSTRATE PANELS AND (4) DEVELOP THE CONCEPTUAL DESIGN FOR A *FULL-SCALE RADCOAT SYSTEM TO BE DEMONSTRATED IN* PHASE II. IF THIS PROJECT IS SUCCESSFUL, A NEW AND INNOVATIVE COATING TECHNOLOGY WILL BE DEMONSTRATED WHICH ENTIRELY ELIMINATES VOCS. THIS WILL SOLVE AN URGENT ENVIRONMENTAL PROBLEM AND PROVIDE A NEW, HIGHLY EFFECTIVE PROCESS FOR APPLYING HIGH QUALITY COATINGS IN NUMEROUS MILITARY APPLICATIONS.

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Topic#: 91-128 ID#: 9120280
Office: LSO
Contract #: DAAH0192CR008
PI: SABINA SHAPIRO
Title: HIGH POWER FLAT PANEL LIGHT SOURCES FOR VISIBLE SIGNATURE CONTROL
Abstract: THIS DOCUMENT DESCRIBES ELECTROLUMINESCENT (EL) LAMPS THAT WILL HAVE LUMINANCE UP TO 300 FOOT-LAMBERT. THE COST OF EACH LAMP WILL BE UNDER $40.00 PER SQUARE METER COMPARED TO A PRICE OF $600.00 PER SQUARE METER IN THE U.S. MARKET. THE EFFICIENCY OF EL LAMPS IS COMPATIBLE TO EFFICIENCY LIDERS SUCH AS FLUORESCENT LAMPS. A SPECIAL POWER INVERTER WILL INCREASE THE USEFUL LIFE OF EL LAMPS AND WILL PROVIDE STABLE OPERATIONS. THE EQUIPMENT REQUIRES MINIMUM MAINTENANCE. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS: THE ANTICIPATED BENEFIT OF THE PROPOSED PROJECT IS A LOW-COST ELECTROLUMINESCENT LAMP THAT CAN BE USED FOR LARGE-SCALE SIGNS AND DISPLAYS IN AIRPORTS, SCHOOLS, PUBLIC BUILDINGS, ETC.

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Topic#: 91-220 ID#: 9121144
Office: MICOM
Contract #: DAAH0192CR127
PI: JOHN WILLIFORD
Title: SUBSTITUTION OF LIQUID CO2 AEROSOLS FOR CFC-113 IN CLEANING OF PRECISION SURFACES AND

MICROELECTRONICS

Abstract: A SIX-MONTH, PHASE I, SMALL BUSINESS INNOVATION RESEARCH (SBIR) PROGRAM IS PROPOSED TO ESTABLISH THE FEASIBILITY OF SUBSTITUTING A NOVEL, PATENTED PROCESS AND COMBINATION OF MATERIALS FOR THE FREON (CFC 113) MATERIALS NOW USED IN HIGH SHEAR CONDITIONS TO CLEAN PRINTED CIRCUIT BOARDS AND OTHER MECHANICAL AND ELECTRONIC COMPONENTS OF INTEREST TO THE DEPARTMENT OF DEFENSE, THROUGH DARPA. THE TECHNOLOGY CONSISTS IN PART IN USING HIGH PRESSURE AND APPROPRIATE ORIFICE TO CREATE AEROSOLS OF SOLVENT, SUCH THAT DISCRETE DROPLETS KNOCK OFF EVEN SUBMICRON SURFACE CONTAMINANT PARTICLES, AS COVERED UNDER U.S. PATENT 4,832,753, ROGER L. CHERRY ET AL., MAY, 1989. A SECOND ASPECT OF THE TECHNOLOGY, COVERED IN A CONTINUATION-IN-PART ISSUED AS U.S. PATENT 4,936,922, JUNE 26, 1990, TREATS THE REFINEMENT OF THE ORIGINAL METHOD BY SUBSTITUTION OF LIQUID C02 FOR THE CHLORINATED SOLVENTS USED IN EARLIER COMMERCIAL PRACTICE. THESE LATER REFINEMENTS HAVE NOT BEEN FULLY DEMONSTRATED TO DATE. IT IS THE PURPOSE OF THIS PHASE I WORK TO REVIEW THE STATUS OF RELATED WORK IN THE LITERATURE, AND TO CONDUCT LIMITED EXPERIMENTAL DEMONSTRATIONS OF THE EFFECT OF C02 AEROSOLS ON STANDING COUPONS, SIMULATING PRINTED WIRING CONTAMINATED WITH TYPICAL FABRICATION RESIDUES. OPTICAL AND ANALYTIC METHODS WILL BE USED TO COMPARE RESULTS WITH CONVENTIONAL TECHNOLOGY. THE RESULTS OF PHASE I ARE EXPECTED TO PROVIDE A CLEAR WARRANT FOR ADAPTING EARLIER, CFC-BASED SYSTEM DESIGNS TO OPERATE WITH SUPERCRITICAL C02 AS A SOLVENT, PRODUCING A COMMERCIALLY USEFUL AND HIGHLY COST-EFFECTIVE TECHNOLOGY IN A PHASE II FOLLOW UP PROJECT. SUBSTITUTION OF LIQUID OR SUPERCRITICAL C02 FOR CFC-113 IN CLEANING OF ELECTRONIC AND MECHANICAL PARTS WILL HAVE AN IMPACT ON THE ORDER OF 19% OF THE BILLION KILOGRAMS OF CFCS CONSUMED ON THE GLOBAL MARKET (1986 ESTIMATE). THESE SOLVENTS ARE USED DOMESTICALLY TO PRODUCE ABOUT $5 BILLION IN GOODS. BENEFICIAL IMPACTS ON AEROSPACE, BIOTECHNOLOGY AND ELECTRONIC INDUSTRIES CAN COME IF BENIGN, EFFECTIVE AND LOW COST SOLVENTS ARE IDENTIFIED.

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Topic#: 91-030 ID#: 9110087
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Contract #: DAAH0191CR272
PI: TODD CERNI

Title: NON-CONTACT TEMPERATURE SENSING FOR HIGH TEMPERATURE MANUFACTURING

Abstract: NON-CONTACT RADIOMETRIC TECHNIQUES REPRESENT AN ATTRACTIVE SOLUTION TO THE DARPA TEMPERATURE MEASUREMENT PROBLEM BECAUSE THEY OFFER A TOTALLY NONINVASIVE MEASUREMENT TECHNIQUE WITH EXCELLENT TEMPORAL AND SPATIAL RESOLUTION. HOWEVER, CONVENTIONAL RADIOMETRIC TECHNIQUES SUFFER FROM PERSISTENT TEMPERATURE MEASUREMENT ERRORS. THE PROPOSED NEW RADIOMETRIC TECHNIQUES ARE CAPABLE OF SOLVING THE TWO PRIMARY MEASUREMENT PROBLEMS IN RADIATION THERMOMETRY, UNKNOWN MATERIAL EMISSIVITY AND REFLECTED BACKGROUND RADIATION. THESE INNOVATIVE NEW TECHNIQUES THEREFORE PROVIDE THE FOUNDATION FOR A NONINVASIVE TEMPERATURE MEASUREMENT AND CONTROL SYSTEM OF UNPRECEDENTED ACCURACY AND RELIABILITY FOR HIGH TEMPERATURE (1000 - 1500 DEGREES CENTIGRADE) MANUFACTURING PROCESSES. THE PROPOSED TECHNIQUES ARE BROADLY APPLICABLE AND NOT LIMITED TO ANY PARTICULAR CLASS OF MATERIALS, MANUFACTURING PROCESSES, OR ENVIRONMENTS. THE PHASE I RESEARCH STRESSES LABORATORY DEMONSTRATION OF THE PROPOSED NON-CONTACT RADIOMETRIC MEASUREMENT TECHNIQUES FOR CONDITIONS AND MATERIALS WHICH SIMULATE RELEVANT HIGH TEMPERATURE MANUFACTURING PROCESSES, COUPLED WITH SIMULTANEOUS DIRECT TEMPERATURE MEASUREMENTS. THE PHASE I RESEARCH ALSO INCLUDES IDENTIFICATION AND EVALUATION OF PHASE II SENSOR DESIGN OPTIONS, PLUS DRAFTING OF ONE OR MORE PRELIMINARY PHASE II SENSOR DESIGNS. THE PROPOSED RESEARCH EFFORT WILL BENEFIT FROM OUR DIRECTLY RELATED EXPERIENCE IN INFRARED RADIOMETRY, NON-CONTACT TEMPERATURE MEASUREMENTS, AND DOD CONTRACTING.

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Topic#: 91-243 ID#: 9120761
Office: ASTO
Contract #: DAAH0192CR057
PI: J. SLADKY,JR.
Title: ULTRA LIGHTWEIGHT STRUCTURES
Abstract: THE PROPOSED ULTRA LIGHTWEIGHT (ULW) STRUCTURAL CONCEPT EMPLOYS A UNIQUE COMPONENT FORMULATION AND FORMING PROCESS. THE CONCEPT IS DESIGNED TO PERMIT THE SIMULTANEOUS SKIN AND CORE FORMING. IN ADDITION PROVISIONS ARE MADE TO ENHANCE THE STRUCTURAL PERFORMANCE IN DYNAMIC LOADING CONDITIONS. THE ULW STRUCTURAL CONCEPT HAS THE POTENTIAL TO SIGNIFICANTLY REDUCE THE STRUCTURAL WEIGHT FRACTION. IN VEHICLES THIS TRANSLATES INTO INCREASED PAYLOAD AND/OR RANGE.

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Topic#: 91-043 ID#: 9110749
Office:
Contract #: DAAH0191CR236
PI: ARTHUR KEEN
Title: AUTOMATED SUPPORT FOR CREATION AND MAINTENANCE OF LARGE SITUATION BASED ONTOLOGIES
Abstract: IN THE CONTEXT OF INFORMATION MANAGEMENT, ONTOLOGY IS THE TASK OF EXTRACTING THE NATURE AND STRUCTURE OF A GIVEN ENGINEERING, MANUFACTURING, BUSINESS, OR LOGISTICAL DOMAIN AND STORING IT IN AN EXPRESSIVELY RICH, USABLE, COMPUTATIONAL FEASIBLE REPRESENTATIONAL MEDIUM. AN ARRAY OF ONTOLOGY DATABASES IN USE ACROSS A WIDE VARIETY OF SUCH SYSTEMS WOULD REVOLUTIONIZE THE TASKS OF INFORMATION MANAGEMENT AND INFORMATION MODELING. HOWEVER, AT PRESENT THERE EXISTS NO GENERAL THEORETICAL CHARACTERIZATION OF THE NATURE OF ONTOLOGICAL INFORMATION AS IT RELATES SPECIFICALLY TO THE ABOVE DOMAINS; NOR ARE THERE ANY METHODS DESIGNED SPECIFICALLY FOR CAPTURING ONTOLOGICAL INFORMATION AND DEVELOPING AND MAINTAINING THIS INFORMATION IN A SHAREABLE, REUSABLE, STANDARDIZED DESCRIPTIVE FORM; HENCE, NEITHER ARE THERE ANY COMPUTATIONAL TOOLS DESIGNED SPECIFICALLY TO COMPLEMENT THESE METHODS. IN THIS PROJECT WE WILL BASE AN APPROACH TO THESE THEORETICAL, METHODOLOGICAL, AND COMPUTATIONAL SHORTFALLS ON A RECENT POWERFUL THEORY OF INFORMATION KNOWN AS SITUATION THEORY. SPECIFICALLY, WE WILL 1) DEVELOP A FORMAL SITUATION THEORETICALLY BASED FOUNDATION FOR ONTOLOGY; 2) REFINE THE AIR FORCE IDEF5 ONTOLOGY DESCRIPTION CAPTURE METHODOLOGY FOR ONTOLOGY CREATION; AND 3) BEGIN INITIAL WORK ON THE PROTOTYPES OF A SUITE OF SOFTWARE SUPPORT TOOLS FOR THE CREATION AND MAINTENANCE OF LARGE SITUATION-BASED ONTOLOGIES. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE IMPORTANCE OF ONTOLOGY DEVELOPMENT WILL CONTINUE TO GROW OVER THE NEXT DECADE. THE SITUATION THEORETIC RESULTS OF THIS PROJECT WILL MOVE THE ONTOLOGY TECHNOLOGY FROM THE CONCEPT PHASE TO A SYSTEMS ENGINEERING DISCIPLINE. THE REFINEMENT OF IDEF5 METHODOLOGY WILL MAKE THIS TECHNOLOGY AVAILABLE TO THE COMMUNITY AT LARGE AND THE TOOLS RESULTING FROM THIS PROJECT WILL ENABLE THE COST EFFECTIVE CREATION,REUSE, AND MAINTENANCE OF LARGE ONTOLOGIES.

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Topic#: 91-050 ID#: 9110750
Office:
Contract #: DAAH0191CR235
PI: PAULA MAYER
Title: RELIABLE OBJECT BASED ARCHITECTURE FOR INTELLIGENT CONTROLLERS (ROCS)
Abstract: RELIABLE OBJECT-BASED CONTROL SOFTWARE (ROCS) IS A PROGRAMMING TECHNOLOGY THAT CAN BE COMBINED WITH BOTH INDUSTRIAL PROGRAMMABLE CONTROLLERS AND POWERFUL RISC BASED PROCESSORS TO CONSTRUCT FLEXIBLE CONTROL COMPONENTS OF GENERAL PURPOSE MACHINE TOOLS. ROCS ALSO SUPPORTS THE COMBINATION OF THOSE COMPONENTS INTO INNOVATIVE STATION, CELL, CENTER OR FACTORY AUTOMATION CONCEPTS. THE PROPOSED TECHNOLOGY WOULD PROVIDE A GENERIC

CONTROL ARCHITECTURE THAT COULD BE CONFIGURED TO THE SPECIFIC REQUIREMENTS OF EACH SPECIALIZED MACHINE TOOLS. THE SOFTWARE TECHNOLOGY ENVISIONED WOULD UTILIZE A "FROZEN" OBJECT APPROACH TO ACHIEVE A LEVEL OF SCALABILITY, FLEXIBILITY, RELIABILITY, AND MAINTAINABILITY CURRENTLY UNATTAINABLE IN PROCESS AUTOMATION. THE ELEMENTS OF THE ROCS SOFTWARE TECHNOLOGY INCLUDE: 1) A SPECIALIZED OBJECT BASED LANGUAGE FOR PROGRAMMING DEVICE CONTROL; 2) A DEVELOPMENT ENVIRONMENT WITH FACILITIES FOR INTERPRETATION, COMPILATION, AND TESTING OF CONTROL PROGRAMS WRITTEN IN THE LANGUAGE; 3) A STANDARD CONTROL ARCHITECTURE FRAMEWORK WITH THE NECESSARY GENERIC CONTROL OBJECT TYPES THAT COULD BE SPECIALIZED TO PROVIDE A LARGE VARIETY OF CONTROL BEHAVIORS OVER A WIDE RANGE OF DEVICES; 4) A CONFIGURATION ENVIRONMENT THAT WOULD SUPPORT THE SETTING OF THE PARAMETERS OF THE OBJECTS IN THE STANDARD CONTROL ARCHITECTURE AND WHICH WOULD THEN AUTOMATICALLY GENERATE THE CONTROL SOFTWARE FOR A SPECIFIC CONFIGURATION OF DEVICES. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - WITH ROCS, SPECIALIZED MACHINE TOOL MANUFACTURING COSTS COULD BE REDUCED BY THE EFFECT OF VOLUME PRODUCTION ECONOMICS APPLIED TO THE PROGRAMMING, AS WELL AS THE CONTROL HARDWARE. THE MODULARITY OF THE RESULTING MACHINING SYSTEM WOULD ENSURE EASIER DIAGNOSIS OF FAULTS AND SELF DIAGNOSIS COULD BE BUILT IN. THE MODULARITY OF THE ARCHITECTURE AND ITS NATURE WOULD EASE THE ADDITION OF NEW DEVICES AND FUNCTIONALITY.

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Topic#: 91-223 ID#: 9120680
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Contract #: DAAH0192CR066
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Title: A KNOWLEDGE-BASED AUTOMATED PROCESS PLANNING SYSTEM (KAPPS) WITH ASSUMPTION-BASED TRUTH MAINTENANCE SYSTEM AND GEOMETRIC

Abstract: THE GOAL OF AMERICAN INDUSTRY LOOKING TO THE FIERCE COMPETITION OF THE NEXT DECADE IS TO MANUFACTURE PRODUCTS (1) AT REDUCED COSTS, (2) WITH SHORTER LEAD TIMES, AND (3) AT A HIGHER QUALITY. COMPONENTS THAT WOULD ASSIST IN ACHIEVING THIS GOAL INCLUDE (1) AUTOMATED PROCESS PLANNING, (2) DESIGN RETRIEVAL, AND (3) PRODUCIBILITY/VALUE ANALYSIS. NEEDED TECHNOLOGICAL BREAKTHROUGHS FOR EFFECTIVE COMPUTER-AIDED PROCESS PLANNING (CAPP) SYSTEMS INCLUDE: (1) INCORPORATION OF POWERFUL GEOMETRIC REASONING CAPABILITIES, (2) INTEGRATION WITH COMPUTER AIDED DESIGN (CAD) AND OTHER ENGINEERING PRODUCT DEFINITION DATABASES, FACTORY MANAGEMENT/CONTROL SYSTEMS, AND COMPUTER AIDED MANUFACTURING (CAM) SYSTEMS, AND (3) DEVELOPMENT OF ROBUST KNOWLEDGE REPRESENTATION STRUCTURES AND REASONING STRATEGIES. AI-BASED EXPERT SYSTEMS HAVE PROVEN TO BE THE MOST PROMISING APPROACH TO SOLVE THE PROCESS PLANNING PROBLEM. WE PROPOSE A KNOWLEDGE-BASED AUTOMATED PROCESS PLANNING SYSTEM (KAPPS) THAT WILL ELIMINATE THE DEFICIENCIES OF CURRENT CAPP SYSTEMS AND BE ABLE TO CAPTURE, REPRESENT, ORGANIZE, AND UTILIZE MANUFACTURING KNOWLEDGE. WE WILL INTEGRATE THE RESULTS OF PREVIOUS AND ONGOING KBSI DEVELOPMENT AND UNIVERSITY RESEARCH IN (1) SHAPE-BASED KNOWLEDGE REPRESENTATION, (2) INFORMATION INTEGRATION MECHANISMS, (3) GEOMETRIC REASONING, (4) ADVANCED OBJECT REPRESENTATION AND REASONING METHODS, AND (5) CONCURRENT ENGINEERING TOOLS TO ACHIEVE A COMMERCIALLY VIABLE, TRULY GENERATIVE PROCESS PLANNING SYSTEM. THE PRODUCT OF THE RESEARCH IS A COMMERCIALLY VIABLE, TRULY GENERATIVE WORKSTATION-BASED PROCESS PLANNING SYSTEM.

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Topic#: 91-218 ID#: 9120681
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Contract #: DAAH0192CR065
PI: MARK PEOT

Title: STANDARD DECISION ANALYSIS MODULES FOR KNOWLEDGE-BASED PLANNING SUPPORT

Abstract: THE OBJECTIVE OF THIS PROGRAM IS TO DESIGN DECISION-ANALYSIS TOOLS FOR THE SUPPORT OF

KNOWLEDGE-BASED PLANNING. CLASSICAL PLANNING SYSTEMS RELY ON A COMPLETE AND CERTAIN DESCRIPTION OF THE ENVIRONMENT. REAL WORLD PLANNING PROBLEMS IN SUCH AREAS AS CRISIS PLANNING AND BATTLEFIELD MANAGEMENT MUST BE SOLVED IN THE FACE OF UNCERTAINTY AND INCOMPLETE KNOWLEDGE. DECISION ANALYSIS PROVIDES THE TOOLS FOR MODELLING PREFERENCES, BELIEFS, AND UNCERTAINTIES FOUND IN THESE PROBLEMS. THIS PROGRAM WILL DESIGN OPERATORS FOR THE INCREMENTAL CONSTRUCTION OF DECISION MODELS AND A SET OF EVALUATION AND ANALYSIS TOOLS FOR PROCESSING THESE MODELS. DECISION MODELS WILL BE DEFINED USING A CLASS INHERITANCE HIERARCHY IN AN OBJECT-ORIENTED LANGUAGE TO FACILITATE THE DESIGN OF CUSTOM REPRESENTATIONS. BUILT-IN REPRESENTATIONS INCLUDE INFLUENCE DIAGRAMS, CONTINGENT INFLUENCE DIAGRAMS, AND BELIEF NETWORKS. EVALUATION TOOLS WILL BE DESIGNED FOR THE EVALUATION OF PROBABILITY DISTRIBUTIONS WITHIN THE MODEL AS WELL AS EVALUATION OF DECISION POLICIES. SEVERAL ANALYSIS TOOLS WILL BE DESIGNED TO ALLOW THE PLANNER TO GAIN MAXIMUM INSIGHT FROM EACH MODEL. THESE TOOLS INCLUDE DETERMINISTIC, OPEN, AND CLOSED-LOOP SENSITIVITY ANALYSIS, AND VALUE OF INFORMATION AND VALUE OF CONTROL CALCULATION. THIS PROGRAM BENEFITS THE PLANNING COMMUNITY BY PROVIDING A COMMON FRAMEWORK FOR THE DEFINITION AND EVALUATION OF DECISION MODELS. THE TOOLS DEVELOPED UNDER THIS PROGRAM FACILITATE THE ENGINEERING OF ANY APPLICATION REQUIRING DECISION ANALYSIS. KNOWLEDGE INDUSTRIES (KI) PLANS TO USE THESE TOOLS TO DEVELOP A NEW GENERATION OF DECISION SUPPORT SYSTEMS FOR APPLICATIONS RANGING FROM MEDICAL DIAGNOSIS TO THE CONTROL AND DESIGN OF COMPLEX MILITARY SYSTEMS.

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Topic#: 91-041 ID#: 9110461
Office:
Contract #: DAAH0191CR234
PI: WILLIAM TEPFENHART
Title: LARGE KNOWLEDGE-BASED SYSTEM BENCHMARKS
Abstract: A BENCHMARK TOOL IS PROPOSED THAT MAKES POSSIBLE MEASUREMENT OF AN EXPERT SYSTEM TOOL'S PERFORMANCE CHARACTERISTICS WHEN APPLIED TO PROBLEMS OF ANY SPECIFIED SIZE AND COMPLEXITY. KEY CAPABILITIES FOR THE PROPOSED TOOL INCLUDE AN ARTIFICIAL KNOWLEDGE BASE GENERATOR, A KNOWLEDGE REPRESENTATION FORMATTER, AN INPUT GENERATOR, AND A RUN ENGINE FOR AUTOMATICALLY ACCRUING PERFORMANCE CHARACTERISTICS.THE PROPOSED ARCHITECTURE IS HIGHLY EXTENDABLE AND CAN EASILY INCORPORATE MORE ADVANCED HYBRID SYSTEMS. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - WE ANTICIPATE THAT THE PROPOSED BENCHMARK TOOL IS AN APPROPRIATED PRODUCT FOR USE BY ANY ORGANIZATION FACED WITH THE PROBLEM OF SELECTING AN EXPERT SYSTEM TOOL FOR DEVELOPMENT OF AN EXPERT SYSTEM.

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Topic#: 91-054 ID#: 9110190
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Contract #: DAAH0191CR258
PI: ANIL AGGARWAL
Title: INTEGRATION OF MULTI-SPECTRAL SENSORS IN MODULAR, OPEN ARCHITECTURE CONTROLLERS FOR PRECISION ...
Abstract: THE OBJECTIVE OF THIS PROPOSED PROGRAM WILL BE TO INVESTIGATE 1) RATIOS, SUMS AND DIFFERENCES; 2) FITTING DISCRIMINANT MODELS; AND 3) FITTING OTHER STATISTICAL AND ENGINEERING MODELS, FOR THE DEVELOPMENT OF AN ACTIVE, REAL TIME, TOOL WEAR MONITORING AND CONTROL SYSTEM. THE USE OF THE "ENERGY CONTENT" AND THE "FREQUENCY SPECTRUM" OF MULTIPLE SENSORS IS PROPOSED FOR THE DEVELOPMENT OF ADEQUATE PROCESS MODELS. THIS PROGRAM WILL ALSO PROVIDE A DETAILED SPECIFICATION OF THE PROPOSED SOFTWARE PACKAGES - PRINCIPLES OF OPERATIONS, INTERFACES, INFORMATION MODELS AND COMMUNICATION FEATURES WITH THE MODULAR, OPEN ARCHITECTURE INTELLIGENT CONTROLLER FOR MACHINE TOOLS. THE FOCUS WILL BE ON ITS USE IN A LARGE SCALE METAL CUTTING ENVIRONMENT. A PLAN OR PROCESS FOR OBTAINING BETA RELEASE

PART QUALITY WILL ALSO BE ADDRESSED. THE EXPERIMENTAL PROGRAM (PHASE II) WILL BE DIRECTED TOWARDS GAINING INSIGHT INTO THE REAL TIME, TOOL WEAR MONITORING SYSTEM; THE SOFTWARE ARCHITECTURE; AND THE COMMUNICATION FEATURES UTILIZING THE SPECIFICATIONS DEVELOPED IN PHASE I. THIS INSIGHT WILL BE USED IN THE DEVELOPMENT OF A RATIONALE FOR INTERFACING WITH A MINIMUM OF THREE METAL CUTTING MACHINE TOOLS AND THEIR RESPECTIVE CONTROLLERS. THE UNDERSTANDING OBTAINED DURING THIS PROGRAM WILL BE USED TO DEVELOP A USER MANUAL WHICH WILL CLEARLY DESCRIBE ANY EXTERNAL INTERFACES OR REQUIREMENTS, AND HOW TO LINK ADDITIONAL METAL CUTTING MACHINES TO THE OVERALL SYSTEM. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE SUCCESSFUL COMPLETION OF THE PHASE I PROGRAM WILL LEAD TO THE EVOLUTION OF INNOVATIVE MULTI-SPECTRAL SENSOR INTEGRATION TECHNOLOGY FOR EFFICIENT AND PRODUCTIVE USE OF MACHINE TOOLS. ITS VALUE WILL HAVE A COMMERCIAL INTEREST TO CONTROL AND MACHINE TOOL BUILDERS.

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Topic#: 91-005 ID#: 9110691
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PI: S.W. LEE

Title: NOVEL CONCEPT FOR EVALUATING CERAMIC ARMOR PENETRATIONS PHENOMENOLOGY

Abstract: DEVELOPMENT AND APPLICATION OF A NOVEL CONCEPT TO MEASURE PENETRATOR INDUCED SHOCK LOADS IN CERAMIC ARMOR IS PROPOSED.EXPLICIT TIME RESOLVED DATA REQUIRED TO UNDERSTAND PENETRATION PHENOMENOLOGY WILL BE OBTAINED USING A NEW PIEZOELECTRIC POLYMER SHOCK GAUGE. A UNIQUE EXPERIMENTAL APPROACH COMBING THE NONOBTRUSIVE SHOCK SENSOR INTO A CONFIGURATION THAT CAN BE FIELDED IN LONG ROD PENETRATOR BALLISTIC TESTING IS PROPOSED. THE UNIQUE SHOCK WAVE INSTRUMENTATION WILL MAKE IT POSSIBLE TO RECORD DATA OVER AN EXTENDED STRESS RANGE (10 TO 2.5 X 10 PA) THAT CANNOT CURRENTLY BE MEASURED. ADDITIONAL BENEFITS PROVIDED BY THIS APPROACH ARE (1) MULTIPLE SENSORS IN EACH EXPERIMENT TO PROVIDE DATA COLLABORATION, (2) FAST RESPONSE TIME (40-60 NS), (3) HIGH SIGNAL-TO-NOISE RATIO AND (4) SELF POWERED. THE NEW APPROACH WILL PROVIDE TIME RESOLVED SHOCK WAVE PROFILE DATA TO SUPPORT CERAMIC MATERIAL MODEL DEVELOPMENT AND DYNAMIC MATERIAL PROPERTIES DETERMINATION. ALSO, THE INSTRUMENTATION IS COMPATIBLE WITH EXISTING LONG ROD PENETRATION TEST CONFIGURATIONS. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - POTENTIAL TECHNICAL BENEFITS OF THIS NOVEL SHOCK MEASUREMENT APPROACH INCLUDE PROVIDING REQUIRED PENETRATION RESISTANCE AND MATERIAL PROPERTIES DATA THAT ARE CURRENTLY NOT AVAILABLE. POTENTIAL COMMERCIAL APPLICATIONS INCLUDE MANUFACTURING AND MARKETING OF A NEW SHOCK WAVE DIAGNOSTIC TO GOVERNMENT AGENCIES, PRIVATE LABORATORIES, AND FIELD TEST ORGANIZATIONS.

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Topic#: 91-126 ID#: 9120732
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Contract #: DAAH0192CR071
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Title: NOVEL CERAMIC/METAL COMPOSITES FOR ARMOR APPLICATIONS

Abstract: CERAMICS HAVE BEEN SHOWN TO BE VERY EFFECTIVE IN THE DEFEAT OF A WIDE RANGE OF KINETIC ENERGY (KE) THREATS. HOWEVER, THE USE OF CERAMICS IN ARMORED VEHICLES HAS BEEN LIMITED DUE IN MOST PART TO THEIR HIGH COST. CERAMIC PARTICULATE REINFORCED METAL MATRIX COMPOSITES (MMCS) PRODUCED BY PRESSURELESS LIQUID METAL INFILTRATION ARE INEXPENSIVE RELATIVE TO MONOLITHIC CERAMICS DUE TO THE LOWER COST OF THE RAW MATERIALS, THE ABILITY TO PRODUCE THE MMCS TO NET SHAPE, AND THE LOWER COST PROCESSING TECHNIQUE. LIKE CERAMICS, MMCS (CONTAINING HIGH LOADINGS (>60 VOL%) OF CERAMIC PARTICLES) CAN PROVIDE VERY EFFECTIVE BALLISTIC PERFORMANCE VERSUS MANY KE THREATS. IN GENERAL, THE PERFORMANCE OF THESE MMCS CAN BE ENHANCED BY INCREASING THE CERAMIC CONTENT. TO THIS END, THE PRESENT WORK IS

PROPOSED. LOW COST NET SHAPE MMCS WILL BE FABRICATED VIA THE PRESSURELESS LIQUID METAL INFILTRATION TECHNIQUE. PROPRIETARY PROCESSING STEPS WILL BE APPLIED TO YIELD A COMPOSITE WITH AN ENHANCED CERAMIC CONTENT. THE FINAL PRODUCT WILL POSSESS THE ECONOMIC ADVANTAGES OF THE CURRENT GENERATION OF MMCS, BUT THE INCREASED CERAMIC CONTENT SHOULD RESULT IN IMPROVED BALLISTIC PERFORMANCE. PHASE I WILL STUDY THE PROCESSING AND QUASI-STATIC PROPERTIES OF THESE NOVEL COMPOSITE MATERIALS. THESE MATERIALS WILL BE ECONOMICAL AND ARE ANTICIPATED TO HAVE FAVORABLE BALLISTIC PERFORMANCE VERSUS A VARIETY OF HEAVY THREATS FACED BY MAIN BATTLE TANKS. POTENTIAL COMMERCIAL APPLICATIONS ARE INDUSTRIAL WEAR COMPONENTS.

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Topic#: 91-150 ID#: 9120689
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Contract #: DAAH0192CR070
PI: LUISA DECKARD

Title: INVESTIGATION OF STRESS WAVES AND FAILURE PHENOMENOLOGY IN ALUMINUM METAL MATRIX COMPOSITE AND TIB2 LAMINATED ARMOR

Abstract: TO UNDERSTAND BETTER HOW LAMINATED CERAMIC ARMOR PERFORMS, IT IS PROPOSED TO INVESTIGATE THE EFFECT OF THE IMPEDANCE MISMATCH AND INTERLAYER BOND STRENGTH (BETWEEN AI(2)0(3) REINFORCED ALUMINUM MATRIX COMPOSITES AND TIB(2)) ON STRESS WAVE PROPAGATION AND PENETRATION PHENOMENOLOGY DUE TO LONG ROD IMPACT. LANXIDE'S UNIQUE PROCESSING TECHNOLOGIES WILL BE USED TO FORM A STRONG METALLURGICAL BOND AT THE INTERFACES IN SOME OF THE TARGETS. THREE OBSERVATION TECHNIQUES WILL BE EMPLOYED, NAMELY (I) PIEZO RESISTANCE STRAIN-COMPENSATED STRESS GAGES FOR STRESS WAVE MEASUREMENTS, (II) HIGH VOLTAGE FLASH X-RAY EQUIPMENT FOR PENETRATION OBSERVATIONS, AND (III) TARGET RECOVERY FOR POST-MORTEM ANALYSIS. LAMINATED ARMORS MADE FROM LAYERS OF DIFFERENT MATERIALS ARE USED FOR BALLISTIC PROTECTION AGAINST ALL TYPES OF KINETIC ENERGY PROJECTILES AND SHAPED CHARGES. ARMORS THAT CONTAIN CERAMICS ARE LAMINATED FOR STRUCTURAL AS WELL AS BALLISTIC REASONS. THE RESULTING INTERFACES CAN EXHIBIT DIFFERENT MISMATCHES OF MECHANICAL IMPEDANCE AND BOND STRENGTHS. THESE INTERFACIAL CHARACTERISTICS CAN BE USED TO CONTROL AND MITIGATE STRESS WAVES PRODUCED BY BALLISTIC IMPACT AND PENETRATION. THE RESULTS FROM PHASE I WILL BE USED IN PHASE II TO DESIGN, FABRICATE AND TEST MULTILAYERED TARGETS. THE EXPERIMENTAL DATA OBTAINED WILL BENEFIT CURRENT PENETRATION MODELING EFFORTS IN THE ARMOR/ANTI-ARMOR COMMUNITY AND WILL PROVIDE NEEDED INFORMATION FOR THE DEVELOPMENT OF A NEW FAMILY OF MULTILAYERED HEAVY ARMOR SYSTEMS COMPRISED OF NOVEL COMBINATIONS OF MATERIALS.

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Topic#: 91-152 ID#: 9120640
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Contract #: DAAH0192CR064
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Title: FAILURE INVESTIGATION OF CERAMIC ARMOR BACKED BY ALUMINUM OR ALUMINUM MATRIX COMPOSITE SUPPORT-PLATES

Abstract: IT IS PROPOSED THAT THE BALLISTIC PERFORMANCE OF TIB2 CERMAIC ARMOR TILES BACKED UP BY A VARIETY OF LIGHTWEIGHT SUPPORT-PLATES BE INVESTIGATED BY 1MEV FLASH X-RAY EQUIPMENT DURING PENETRATION, AND BY MACROSCOPIC AND MICROSCOPIC OBSERVATIONS OF RECOVERED TARGETS. THE SUPPORT-PLATE TEST MATRIX INCLUDES TWO MATERIALS (A STRUCTURAL ALUMINUM ALLOY AND A CERAMIC REINFORCED ALUMINUM MATRIX COMPOSITE), TWO THICKNESSES, AND ONE PLATE WITH THROUGH HOLES FOR REDUCED WEIGHT. IN ADDITION, AN EPOXY BOND WILL BE COMPARED TO A METALLURGICAL BOND. IN PREVIOUS WORK, BALLISTIC TEST RESULTS HAVE SHOWN THAT THIN METAL PLATES (SUPPORT-PLATES) BONDED TO THE BACK OF ARMOR CERAMICS HAVE SIGNIFICANTLY IMPROVED THE PENETRATION RESISTANCE OF THE SYSTEMS IN WHICH THESE MACROCOMPOSITES WERE EMPLOYED. HOWEVER, THE MECHANISMS BY WHICH THESE SUPPORT-PLATES ENHANCE PENETRATION

RESISTANCE, THE DESIRABLE SUPPORT-PLATE PROPERTIES, AND THE REQUISITE CERAMIC TO SUPPORT-PLATE BOND CHARACTERISTICS ARE NOT WELL UNDERSTOOD. THE PURPOSE OF THE PROPOSED PROGRAM IS TO DEVELOP A BETTER UNDERSTANDING OF THESE IMPORTANT EFFECTS. THE INSIGHTS PROVIDED BY THE PROPOSED PHASE I INVESTIGATION WILL GUIDE THE DEVELOPMENT AND TESTING OF GRADED COMPOSITES IN PHASE II. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE EXPERIMENTAL DATA OBTAINED WILL BENEFIT CURRENT PENETRATION MODELING EFFORTS IN THE ARMOR/ANTI-ARMOR COMMUNITY, WILL PROVIDE USEFUL INFORMATION FOR THE DESIGN AND OPTIMIZATION OF LAMINATED MACROCOMPOSITE CERAMIC/METAL APPLIQUE ARMORS, AND WILL CONTRIBUTE TO THE INFORMATION BASE REQUIRED FOR THE DEVELOPMENT OF ONE PIECE GRADED APPLIQUE ARMORS THAT DO NOT REQUIRE A SUPPORT-PLATE.

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Topic#: 91-061 ID#: 9110074
Office:
Contract #: DAAH0191CR179
PI: BRADLEY MELLS

Title: SEMICONDUCTOR LASER EXCITED UPCONVERSION TRANSITIONS IN HOLMIUM (SLEUTH)

Abstract: A BLUE-GREEN LASER IS PROPOSED WHICH IMPLEMENTS UPCONVERSION ENERGY TRANSFER PROCESSES TO EXCITE THE 5G6 5I8 LASER TRANSITION IN HO3+ IS HIGHLY PROMISING FOR SUBMARINE COMMUNICATIONS APPLICATIONS AS THE WAVELENGTH OF THIS TRANSITION IS EXTREMELY CLOSE TO THE 6S1/2 7P3/2 RESONANT ADSORPTION IN CESIUM (455.66NM). THE RESULTS OF CALCULATIONS APPLYING THE JUDD-OFELT APPROXIMATIONS INDICATE A LARGE OSCILLATOR STRENGTH CORRESPONDING TO THIS LASER TRANSITION. THE PROGRAM WILL INVESTIGATE 455 NM STIMULATED EMISSION IN HO:BAY2F8. THIS HOST LATTICE IS PROMISING FOR UPCONVERSION PUMPING SINCE IT SUPPORTS UPCONVERSION VIA PAIR PROCESSES FOR EFFICIENT LASER OPERATION. IN ADDITION THIS CRYSTAL HAS LOW ASSOCIATED PHONON ENERGIES, SUBSTANTIALLY REDUCING THE PROBABILITY OF UPPER LASER LEVEL DEPLETION THROUGH NON-RADIATIVE TRANSITIONS. THE 5I8 5I5 PUMP TRANSITION AT 908 NM IS COMPATIBLE WITH STRAINED LAYER IN GAAS QUANTUM WELL TECHNOLOGY. THIS IS A VIABLE PUMP LASER TECHNOLOGY SINCE STRAINED QUANTUM WELL DEVICES HAVE DEMONSTRATED HIGH RELIABILITY WITH STRAINED LAYERS NEAR THE CRITICAL THICKNESS. THE 908 NM OUTPUT REQUIRED ACCOMMODATES MUCH NARROWER STRAINED LAYER THICKNESSES RESULTING IN REDUCED STRESS ON THE ACTIVE LAYER AND IMPROVED RELIABILITY OF THE DIODE LASER PUMP SOURCE. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE PROPOSED SYSTEM HOLDS PROMISE FOR EFFICIENT GENERATION OF NARROWBAND LASER RADIATION WHICH IS COMPATIBLE WITH THE CS ATOMIC RESONANCE FILTER. IN ADDITION TO SUBMARINE COMMUNICATIONS, THE BLUE-GREEN OUTPUTS ARE SUITABLE FOR APPLICATIONS IN FLUORESCENCE SPECTROSCOPY, HIGH RESOLUTION IMAGING, MEASUREMENTS AND CONTROL SYSTEMS AS WELL AS OPTICAL MEMORY TECHNOLOGY.

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Topic#: 91-117 ID#: 9120051
Office: DSO
Contract #: DAAH0192CR079
PI: MAURICE PESSOT

Title: ELECTRO-OPTICALLY Q-SWITCHED MICROCHIP LASERS

Abstract: MICROCHIP LASERS HOLD THE POTENTIAL FOR LOW COST, MASS PRODUCIBLE SINGLE FREQUENCY SOURCES WHICH CAN BE CONFIGURED INTO LINEAR AND TWO DIMENSIONAL ARRAYS. LASER POWER RESEARCH HAS DEVISED A METHOD BY WHICH MICROCHIP LASERS MAY BE Q-SWITCHED TO PRODUCE SUBNANOSECOND, KILOWATT PEAK POWER PULSES. AT THIS POWER LEVEL, NONLINEAR FREQUENCY CONVERSION TECHNIQUES CAN BE QUITE EFFICIENT, THUS OFFERING AN ALTERNATIVE TO SEMICONDUCTOR LASER SOURCES IN THE VISIBLE AND NEAR-UV REGION OF THE SPECTRUM. IN CONTRAST TO PREVIOUS Q-SWITCH MICROCHIP LASERS, THE LPR DESIGN RELIES ON THE ELECTRO-OPTIC EFFECT FOR FAST SWITCHING OF THE CAVITY. A FIELD APPLIED TO AN ELECTRO-OPTIC ETALON USED AS THE OUTPUT CAVITY MIRROR IS USED TO RAPIDLY SHIFT THE RESONANCE FREQUENCIES OF THE ETALON,

THEREBY MODULATING THE EFFECTIVE REFLECTIVITY OF THE OUTPUT CAVITY MIRROR. BONDING THE ETALON DIRECTLY TO THE MICROCHIP GAIN MEDIUM RESULTS IN A FULLY INTEGRATED UNIT, THE DESIGN OF WHICH IS AMENABLE TO EXPANSION INTO ONE AND TWO DIMENSIONAL ARRAYS. THE PROPOSED PHASE I PROGRAM INCLUDES A PROOF-OF-PRINCIPLE EXPERIMENT DESIGNED TO GENERATE 100-200 PICOSECOND PULSES FROM AN INTEGRATED, Q-SWITCHED ND:YAG MICROCHIP LASER, AS WELL AS A MATERIALS SURVEY TO IDENTIFY SUITABLE MATERIALS FOR THE DEVELOPMENT OF DIODE PUMPED MICROCHIP SOURCES. SUCCESSFUL DEMONSTRATION OF THE PROPOSED MICROCHIP LASER SKILL POINT THE WAY TOWARDS THE DEVELOPMENT OF COMPACT, INEXPENSIVE SOURCES IN THE VISIBLE AND NEAR UV. SUCH SOURCES HAVE TREMENDOUS COMMERCIAL POTENTIAL IN SUCH AREAS AS OPTICAL DISK STORAGE AND, IN THE FORM OF ARRAYS, FOR PARALLEL OPTICAL PROCESSING. THE COMPACTNESS AND RUGGEDNESS OF THE DEVICES IS ATTRACTIVE FOR MILITARY SYSTEMS.

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Topic#: 91-128 ID#: 9120200
Office: LSO
Contract #: DAAH0192CR019
PI: NATHANIEL MASS

Title: FLEXIBLE LARGE AREA HIGH INTENSITY LIGHT PANELS

Abstract: WE PROPOSE A FLAT FLEXIBLE HIGH INTENSITY LIGHT SOURCE FOR USE AS A VISUAL SIGNATURE MODIFIER. THE LIGHT SOURCE'S INTENSITY AS WELL AS ITS SPECTRAL DISTRIBUTION CAN BE CONTROLLED BY ELECTRONIC MEANS. FURTHERMORE, THE SYSTEM CAN BE DESIGNED TO PROVIDE HIGH INTENSITY LIGHT OUTPUT IN THE NEAR INFRARED AS WELL. THE PROPOSED SYSTEM IS MODULAR AND PORTABLE IN NATURE, BEING IN ESSENCE INFLATED TO ITS FLAT FINAL FORM IN THE FIELD. INITIAL CONVERSION EFFICIENCY OF ELECTRICAL POWER TO RADIANT ENERGY IS ESTIMATED TO EXCEED 10%, AND WITH POSSIBLE INCORPORATION OF FUTURE HIGH EFFICIENCY LIGHT SOURCES, EFFICIENCIES IN EXCESS OF 20% COULD BE ACHIEVED. PRODUCTION COSTS FOR COMMERCIAL QUANTITIES OF THE PROPOSED SYSTEM ARE ESTIMATED AT UNDER 1000 $/M2. VERSATILE OPTICAL SIGNATURE MODIFIER WHICH CAN BE SPECTRALLY MODULATED, IS FLEXIBLE AND PORTABLE. COMMERCIAL APPLICATIONS IN CLEAN ROOMS, HAZARDOUS PLANT ENVIRONMENTS WHERE SOURCES AND EMITTING SURFACES NEED BE SEPARATED. LIGHT SOURCES FOR CIRCADIAN ADJUSTMENT, SHIFT WORK, JET LAG, ELDERLY, SLEEP DISORDER, AND MILITARY RAPID DEPLOYMENT.

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Topic#: 91-118 ID#: 9120204
Office: DSO
Contract #: DAAH0192CR080
PI: D. GERSTENBERGER

Title: DEVELOPMENT OF AN INFRARED OPTICAL PARAMETRIC OSCILLATOR DRIVEN BY A DIODE-PUMPED 2μM LASER

Abstract: THIS RESEARCH PROJECT WILL INVESTIGATE COMPACT AND EFFICIENT TUNABLE SOLID-STATE LASER SOURCES IN THE 3-5 MICRON SPECTRAL REGION BASED ON OPTICAL PARAMETRIC OSCILLATORS (OPOS) PUMPED BY DIODE-LASER-PUMPED SINGLE-FREQUENCY 2 MICRON LASERS. THE USE OF DIODE LASER PUMP SOURCES FOR COHERENT SOURCES IN THIS SPECTRAL RANGE PROVIDES FOR HIGHLY EFFICIENT, COMPACT AND LONG-LIVED DEVICES. THE PHASE I PROGRAM WILL ESTIMATE THE PERFORMANCE OF OPOS BASED ON SILVER GALLIUM SELENIDE AND ZINC GERMANIUM PHOSPHIDE AND DETERMINE THE REQUIREMENTS OF A DIODE-PUMPED TM:YAG OR TM:HO:YAG LASERS TO PROVIDE OPO OUTPUT POWERS IN THE TENS TO HUNDREDS OF WATTS. SUCCESSFUL COMPLETION OF THIS PROGRAM THROUGH PHASE 11 WOULD DEMONSTRATE THE FEASIBILITY OF 3-5 MICRON SOURCES USING DIODE-PUMPED 2 MICRON LASERS. IN ADDITION TO FREQUENCY-AGILE RADAR APPLICATIONS, SOURCES IN THIS SPECTRAL REGION WOULD HAVE APPLICATIONS FOR DETECTION AND MONITORING OF A NUMBER OF ATMOSPHERIC CONSTITUENTS SUCH AS C02, CO, CH4, N20 AND S02 AND POSSIBLY MEDICAL APPLICATIONS.

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Topic#: 91-225 ID#: 9120469
Office: MICOM
Contract #: DAAH0192CR153
PI: DAVID SHANNON

Title: EFFICIENT COUPLING OF GALLIUM ARSENIDE LASER DIODE OUTPUT INTO A FIBER OPTIC FOR REMOTE POWER TRANSMISSION

Abstract: AN EFFICIENT OPTICAL POWER MODULE IS NEEDED AS THE MAIN COMPONENT IN A REMOTE ELECTRICAL POWER SYSTEM. THIS PROPOSAL OUTLINES THE DESIGN, CONSTRUCTION, AND CHARACTERIZATION OF A FIBER-COUPLED, GALLIUM ARSENIDE DIODE LASER POWER MODULE THAT WILL MEET OR EXCEED THE SPECIFICATIONS SET FORTH BY DARPA. THE POWER MODULE WILL CONSIST OF THREE 3 WATT GALLIUM ARSENIDE DIODE LASERS (9 WATTS TOTAL) COUPLED INTO A 400 UM DIAMETER FIBER OPTIC. THE OUTPUT POWER WILL BE IN EXCESS OF 7 WATTS (80% COUPLING EFFICIENCY) WITH A NUMERICAL APERTURE OF ROUGHLY 0.2. THE WALL PLUG EFFICIENCY WILL BE 10% DEFINED AS THE OPTICAL POWER EMITTED BY THE FIBER DIVIDED BY THE ELECTRICAL POWER (AT 120 VAC) REQUIRED TO OPERATE THE DEVICE. A NOVEL FEATURE OF THIS DESIGN IS THAT THE FIBER DIAMETER, OUTPUT NUMERICAL APERTURE, AND COUPLING EFFICIENCY ALL REMAIN ROUGHLY CONSTANT AS THIS DESIGN IS SCALED TO HIGHER POWER. WITH ADDITIONAL DIODE LASERS, THIS POWER MODULE WILL SCALE TO 25 WATTS OF EMITTED POWER. HIGH POWER FIBER OPTIC SOURCES OF DIODE LASER LIGHT HAVE STRONG COMMERCIAL APPLICATION IN THE AREAS OF REMOTE POWER TRANSMISSION, DIODE-PUMPED SOLID-STATE LASERS, AND LASER SURGERY. THE LOW OUTPUT DIVERGENCE OF THIS OPTICAL SOURCE WILL PERMIT HIGH INTENSITY FOCUSING AS WELL AS LOW-LOSS POWER TRANSMISSION OVER LONG DISTANCES.

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Topic#: 91-216 ID#: 9120271
Office: SSTO
Contract #: DAAH0192CR186
PI: LYNNE GILFILLAN

Title: EVALUATION METHODS AND METRICS FOR IMAGE PROCESSING AND UNDERSTANDING SYSTEMS

Abstract: THE PROJECT PROPOSED WILL DEVELOP A SUITE OF METRICS FOR THE EVALUATION OF OVERALL PERFORMANCE OF IU SYSTEMS, AS WELL AS FOR THE ASSESSMENT AND DIAGNOSIS OF INDIVIDUAL SYSTEM COMPONENTS. THE METRICS WILL ADDRESS THE ISSUES OF THE GENERALITY AND STANDARDIZATION OF METRICS TO PERMIT CROSS-SYSTEM COMPARISONS. THE DIMENSIONS TO BE INVESTIGATED FOR METRICS DEVELOPMENT WILL INCLUDE: ACCURACY, COMPATIBILITY, CONFORMITY, COMPUTATION EFFICIENCY, COST/BENEFIT, EASE OF USE, FLEXIBILITY, ROBUSTNESS, SPEED, TRANSPORTABILITY, AND UTILITY. INDIVIDUAL METRICS WILL BE DEVELOPED FOR THE FOLLOWING SYSTEM COMPONENTS: SCENE REGISTRATION, IMAGE FEATURE EXTRACTION, SCENE OBJECT MODELLING, THE KNOWLEDGE INTERFACE, AND THE CONTROL TECTURE. THE PROPOSED METRICS WILL BE REVIEWED FOR CONFORMANCE TO TECHNICAL STANDARDS, SUCH AS PRECISION AND VALIDITY, AND FOR OVERALL UTILITY. DETAILED PROCEDURES WILL BE PROVIDED FOR EACH METRIC, TO ENSURE APPROPRIATE APPLICATION. IN ADDITION TO THE METRICS THEMSELVES, WE PROPOSE TO RECOMMEND A WEIGHTING SYSTEM, THAT WILL PERMIT END-USERS AND DEVELOPERS TO AGGREGATE MULTIPLE METRICS INTO A SINGLE MEASURE, REFLECTING THE IMPORTANCE THAT THEY ATTACH TO THE INDIVIDUAL DIMENSIONS AND COMPONENTS. FINALLY, WE WILL DEVELOP A PROPOSED ARCHITECTURE FOR A DATABASE SUPPORTING INFORMATION ACCESS TO METRICS AND PROCEDURES, AS WELL AS TO DATA FROM OTHER EVALUATIONS, AND EVENTUALLY TO BENCHMARK RESULTS. THERE ARE TWO MAJOR BENEFITS ANTICIPATED. THE FIRST IS THE DEVELOPMENT OF A STANDARD SET OF UNBIASED METRICS THAT WILL PERMIT CROSS-SYSTEM COMPARISONS. THIS WILL BE PARTICULARLY USEFUL FOR PROCUREMENT DECISIONS. THE SECOND IS THE DEVELOPMENT OF A SET OF STANDARD METRICS FOR THE EVALUATION OF SYSTEM COMPONENTS THAT WILL PERMIT BOTH PERFORMANCE ASSESSMENTS OF SEPARATE COMPONENTS, AS WELL AS DIAGNOSTIC EVALUATION OF THESE COMPONENTS, AND IDENTIFICATION OF FAILURE POINTS AND AREAS MOST LIKELY TO BENEFIT FROM IMPROVEMENT.

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Topic#: 91-221 ID#: 9120357
Office: MICOM
Contract #: DAAH0192CR158
PI: LAWRENCE GRZYLL
Title: DEVELOPMENT OF ENVIRONMENTALLY ACCEPTABLE HALON ALTERNATIVES
Abstract: PHASE I OF THIS EFFORT PROPOSES TO DETERMINE THE FEASIBILITY OF USING THE COMPUTATIONAL CHEMISTRY DATABASE SYSTEM FOR IDENTIFYING SUITABLE FIRE-SUPPRESSION ALTERNATIVES. DATA ON THE PHYSICAL, CHEMICAL, STRUCTURAL, THERMODYNAMIC, AND FIRE-SUPPRESSION PROPERTIES ON AS MANY COMPOUNDS AS POSSIBLE WILL BE ADDED TO THE DATABASE. THE COMPUTATIONAL CHEMISTRY DATABASE SYSTEM WILL THEN BE USED TO IDENTIFY CANDIDATE COMPOUNDS WITH IMPROVED FIRE-SUPPRESSION PROPERTIES OVER PREVIOUS MOLECULES. THE FIRE-SUPPRESSION PROPERTIES OF THE CANDIDATE COMPOUNDS WILL BE EXPERIMENTALLY VERIFIED AND ADDED TO THE DATABASE, EXPANDING AND IMPROVING IT. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - SINCE ELIMINATING THE USE OF OZONE-DAMAGING COMPOUNDS IS CALLED FOR IN THE MONTREAL PROTOCOL, THIS METHOD OF FINDING ALTERNATIVE COMPOUNDS COULD BE USED BY THE COMMERCIAL SECTOR FOR DEVELOPING REFRIGERANT ALTERNATIVES AND SOLVENT ALTERNATIVES AS WELL AS FIRE-SUPPRESSION ALTERNATIVES.

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Topic#: 91-003 ID#: 9110372
Office:
Contract #: DAAH0191CR269
PI: JOHN MORRISON
Title: DISTRIBUTED INTERACTIVE SIMULATION PROTOCOL EXTENSIONS FOR LOGISTICS SIMULATION
Abstract: THIS PROJECT PROPOSES TO INCREASE THE FIDELITY OF LOGISTICS IN DISTRIBUTED INTERACTIVE SIMULATIONS (DIS). THE SIMNET SYSTEM AND PROTOCOLS ARE USED AS A WORKING MODEL. SIMNET (SHORT FOR SIMULATOR NETWORKING) IS A SYSTEM OF NETWORKED COMBAT VEHICLE SIMULATORS DESIGNED FOR COMBINED ARMS TACTICAL TRAINING. THE LOGISTICS PORTION OF SIMNET IS A LOW FIDELITY MODEL, SUPPLYING THE BARE MINIMUM LOGISTICS SUPPORT NECESSARY TO SUPPLY COMBAT TRAINING MISSIONS. VERY LITTLE EFFORT WAS MADE TO PROVIDE LOGISTICIANS AN OPPORTUNITY TO EXERCISE THEIR SKILLS. SINCE THERE WAS NO REQUIREMENT FOR A HIGH FIDELITY LOGISTICS MODEL, MANY NECESSARY FEATURES WERE LEFT OUT OF THE VIRTUAL WORLD.THIS PROPOSAL IDENTIFIES SOME OF THE SHORTCOMINGS IN THE SIMNET MODEL AND OFFERS POTENTIAL SOLUTIONS. A FOUR-PRONGED APPROACH IS OUTLINED: 1) ADD PERSONNEL CONSIDERATIONS TO SIMNET COMBAT MODELS AND LOGISTICS SYSTEMS; 2) INCREASE FIDELITY OF LOGISTICS VEHICLES LEVERAGING ON SIMNET SEMI AUTOMATED FORCES TECHNOLOGY; 3) ENHANCE DIS PROTOCOLS TO ENABLE TOWING AND OTHER NEWTONIAN INTERACTIONS BETWEEN VEHICLES; 4) ENHANCE DIS PROTOCOLS TO ENABLE REPAIR OF COMBAT SYSTEMS, BY DESCRIBING THEM AS COMPLEX COMPOSITE OBJECTS. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE PROPOSED PROTOCOLS WILL ENABLE TRAINING AND SIMULATION APPLICATION NOT POSSIBLE IN CURRENT DIS SYSTEMS. THESE INCLUDE: CARRIER LANDING, IN-FLIGHT REFUELING, AIR-DROP OF COMBAT VEHICLES, AND TRAINING IN MAINTENANCE AND REPAIR OF COMPLEX COMBAT SYSTEMS.

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Topic#: 91-142 ID#: 9120600
Office: LSO
Contract #: DAAH0192CR027
PI: WARREN KATZ
Title: MODULAR SOFTWARE AND HARDWARE FOR RAPID CREATION OF DIS SIMULATORS
Abstract: DISTRIBUTED INTERACTIVE SIMULATION (DIS) SIMULATORS, DEVELOPED BY DARPA UNDER THE SIMNET PROGRAM, ARE CURRENTLY BEING USED FOR COMBINED ARMS TACTICAL TRAINING, AS WELL AS A CONTROLLED TESTBED FOR HYPOTHETICAL WEAPON SYSTEMS. BY INSERTING A SIMULATOR OF A HYPOTHETICAL VEHICLE INTO THE SIMNET WORLD, TRADEOFF STUDIES CAN BE PERFORMED ON THE

VEHICLE, REFINING THE WEAPON SYSTEM CONCEPT. GREAT COST SAVINGS ARE ENJOYED BY CUTTING DOWN ITERATIVE PROTOTYPING OF REAL HARDWARE. A MAJOR PROBLEM WITH THIS METHODOLOGY, HOWEVER, IS THAT THE DESIGNER OF THESE WEAPON SYSTEMS HAS NO TOOL TO RAPIDLY CREATE THE SIMULATORS HIMSELF. HARDWARE AND SOFTWARE DEVELOPERS NEED TO BE BROUGHT IN TO THE LOOP, WASTING TIME AND MONEY. IF THE DESIGNER COULD GENERATE THESE SIMULATORS UNASSISTED, THE TIME BETWEEN CONCEPT ITERATIONS WOULD PLUMMET, AS WOULD THE COST. MAK PROPOSES USING OBJECT ORIENTED DESIGN PARADIGMS, STANDARDIZED SOFTWARE INTERFACES, RECONFIGURABLE I/O OBJECTS, AND RECONFIGURABLE CONTROLS TO PROVIDE A WEAPON DESIGNER WITH A WEAPON GENERATION TOOL (WGT) WHICH WOULD ALLOW HIM TO CREATE HIS OWN SIMULATORS FROM A LIBRARY OF PARTS. THIS TOOL WOULD DYNAMICALLY LINK SOFTWARE AND HARDWARE MODULES AT THE REQUEST OF THE DESIGNER, THROUGH AN EASY TO USE GRAPHICAL USER INTERFACE. THE WGT WILL ACCELERATE THE PROCESS OF WEAPON SYSTEM REFINEMENT, MULTIPLYING THE POWER OF THE SIMNET SIMULATE-BEFORE-YOU-BUILD PROCUREMENT METHODOLOGY. THE WEAPON DESIGNER WILL HAVE AN AS-OF-YET UNAVAILABLE FREEDOM TO EXPLORE NEW AREAS IN COMBAT SYSTEM DEVELOPMENT. THE WGT CAN BE USED BY COMMERCIAL VEHICLE MANUFACTURERS FOR TRADEOFF STUDIES IN SIMULATION, SIMILAR TO THE MILITARY WEAPONS DESIGNER.

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Topic#: 91-149 ID#: 9120072
Office: LSO
Contract #: DAAH0192CR203
PI: EDWARD BUCHANAN

Title: A PROPOSAL TO EVALUATE THE MANUFACTURE OF HEAVY METAL SHAPED-CHARGE LINERS USING THE VACUUM PLASMA SPRAY-FORM PROCESS...

Abstract: PREVIOUS EFFORTS TO SPRAY-FORM METAL STRUCTURES USING CONVENTIONAL PLASMA SPRAY HAVE USUALLY RESULTED IN SHAPES WHICH HAD VERY LIMITED DUCTILITY BECAUSE OF EXCESSIVE POROSITY AND OXIDATION. IT HAS RECENTLY BEEN SHOWN THAT THE SPRAY OF METALS IN A NEAR-VACUUM ENVIRONMENT VIRTUALLY ELIMINATES THESE LIMITATIONS. THE VACUUM PLASMA SPRAY-FORM PROCESS CAN THUS BE USED TO MANUFACTURE CERTAIN METAL SHAPES WHICH ARE DIFFICULT OR IMPOSSIBLE TO FORM BY CONVENTIONAL PROCESSES SUCH AS CASTING OR FORGING. THIS IS PARTICULARLY TRUE FOR REFRACTORY METALS BECAUSE THEIR HIGH MELTING POINT MAKES CASTING AND FORGING DIFFICULT. THE VACUUM PLASMA SPRAY-FORM PROCESS HAS MANY OTHER ADVANTAGES FOR THE MANUFACTURE OF SHAPED-CHARGE LINERS. FOR INSTANCE, THE PROCESS IS A RELATIVELY COOL PROCESS, IN THAT THE MANDREL BEING SPRAYED CAN KEPT BELOW 250. SHAPES CAN THUS BE FORMED TO A HIGH DEGREE OF DIMENSIONAL ACCURACY, ⊾^A WHICH ELIMINATES OR REDUCES THE AMOUNT OF POST-DEPOSITION FINISHING REQUIRED. THE PROCESS IS ALSO AMENABLE TO HIGH-PRODUCTION OUTPUT, AND PARTS FORMED BY THE PROCESS ARE CHARACTERIZED BY FINE GRAIN SIZE, FREEDOM FROM SEGREGATION, AND MICROSTRUCTURAL UNIFORMITY. THIS PROPOSAL OUTLINES A PLAN TO COMPARE THE METALLURGICAL AND MECHANICAL PROPERTIES OF SEVERAL VACUUM PLASMA SPRAY-FORMED REFRACTORY METALS TO THOSE OF THE SAME REFRACTORY METALS MANUFACTURED USING CONVENTIONAL TECHNIQUES, AND TO MANUFACTURE TWELVE 81-MM SHAPED CHARGE LINERS FOR GOVERNMENT ANALYSIS. THE DEMONSTRATED CAPABILITY OF THE VACUUM PLASMA SPRAY PROCESS TO FORM REFRACTORY METAL SHAPES WILL HAVE IMPORTANT COMMERCIAL IMPLICATIONS. THE PROCESS CAN ALSO BE USED TO FORM REFRACTORY METAL SHAPES FOR THE AEROSPACE, CHEMICAL, AND NUCLEAR INDUSTRIES, AMONG OTHERS.

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Topic#: 91-001 ID#: 9110709
Office:
Contract #: DAAH0191CR187
PI: AUGUST RIHACZEK

Title: INNOVATIVE DETECTION AND TARGETING SENSORS FOR CAMOUFLAGED, LOW RADAR CROSS SECTION ...

Abstract: MARK RESOURCES HAS DEVELOPED A NEW SIGNAL PROCESSING TECHNOLOGY FOR EXTRACTING INFORMATION ABOUT A TARGET FROM THE RETURN SIGNAL. IT HAS BEEN APPLIED WITH CONSIDERABLE SUCCESS IN THE DISCRIMINATION AND IDENTIFICATION OF TARGETS, AND HAS RECENTLY BEEN USED TO DETECT CONCEALED TARGETS. WE PROPOSE TO INVESTIGATE THE UTILITY OF COMBINING THIS TECHNOLOGY WITH POLARIZATION DIVERSITY TO IMPROVE THE DETECTION AND IDENTIFICATION OF LOW-CROSS SECTION AND CONCEALED GROUND TARGETS. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - A SAR SYSTEM WITH THE CAPABILITY OF DETECTING WELL CONCEALED TARGETS COULD ALSO BE USED TO DETECT ILLICIT ACTIVITY CONCEALED IN TREES, SUCH AS DRUG LABORATORIES AND STILLS.

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Topic#: 91-151 ID#: 9120248
Office: ASTO
Contract #: DAAH0192CR030
PI: JAMES BOGGS

Title: EXPLORATION OF TECHNIQUES FOR SEMI-AUTOMATED INTELLIGENCE SUMMARY GENERATION
Abstract: THIS PROJECT WILL PROVIDE AN ANALYSIS OF THE TECHNICAL ISSUES RELATED TO AUTOMATED INTELLIGENCE SUMMARY GENERATION. THIS ANALYSIS WILL REFINE AN APPROACH TO: (1) USER INTERACTION WITH THE SEMI-AUTOMATED INTSUM DEVELOPER, (2) USE OF DYNAMIC MESSAGE DATA FROM EXISTING TACTICAL DATA SYSTEMS, (3) MATCHING POTENTIAL TACTICS WITH THE FRIENDLY MISSION AND PERCEIVED SITUATION. THE SIGNIFICANCE OF A METHOD CAPABLE OF SUPPORTING MULTIPLE FORMATS WILL BE DEMONSTRATED IN A LABORATORY USING COMPUTER SIMULATION DURING PHASE II. THE BASIC TECHNIQUE OF USING OBJECT-BASED REPRESENTATION FOR THE ENEMY ACTIVITY INDICATORS, INTERFACING TO DYNAMIC DATA, AND SUMMARIZING REPORTED INFORMATION MAY HAVE COMMERCIAL USES AS WELL AS APPLICATION IN DEFENSE-RELATED INTELLIGENCE SUPPORT SYSTEMS. THE RESULTING APPROACH TO KNOWLEDGE REPRESENTATION, PARSING AND CORRELATING REPORTS PROPOSED CAN PROVIDE A NEEDED CAPABILITY IN BUSINESS TREND PREDICTION AS WELL.

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Topic#: 91-093 ID#: 9121158
Office: DSO
Contract #: DAAH0192CR026
PI: R. LOUTFY

Title: THE CONVERSION OF GRAPHITE FIBER AND PREWOVEN ARCHITECTURES TO B4C FIBERS
Abstract: CURRENT CERAMIC FIBERS LOSE STRENGTH RAPIDLY ABOVE 1000-1200 C AND HAVE VERY LOW CREEP RESISTANCE THUS LIMITING THEIR APPLICATIONS IN COMPOSITES FOR MANY ADVANCED MILITARY SYSTEMS. RECENT WORK HAS DEMONSTRATED THAT GRAPHITE FIBER (3-14) TOWS CAN BE CONVERTED TO SIC WHICH RETAINS NEARLY 100% OF THEIR STRENGTH TO 1500 C AND HAVE EXCELLENT CREEP RESISTANCE TO THE SAME TEMPERATURE. PRELIMINARY INVESTIGATIONS SHOW POTENTIAL FOR CONVERTING PREWOVEN GRAPHITE ARCHITECTURES TO SIC THUS OBVIATING THE NECESSITY TO WEAVE SIC FIBER. THIS PROGRAM PROPOSES TO UTILIZE THE CONCEPT OF CONVERTING GRAPHITE FIBER TO A CARBIDE TO DEVELOP BORON CARBIDE FIBER. THE CONVERSION CONCEPT WILL BE INVESTIGATED TO CONVERT PREWOVEN GRAPHITE ARCHITECTURES INTO SIC-B4C COMPOSITIONS AND B4C. BASED ON THE EXCELLENT STRENGTH AND CREEP PROPERTIES DEMONSTRATED FOR CONVERTING GRAPHITE TOWS TO SIC AND CONVERSION OF GRAPHITE CLOTH THE CONVERSION PROCESS PROMISES TO BECOME A VERY LOW COST MANUFACTURING METHOD TO PRODUCE CARBIDE FIBERS AND PREWOVEN ARCHITECTURES WHICH MAINTAIN HIGH STRENGTH AND CREEP RESISTANCE AT TEMPERATURES UP TO 1500 C. LOW COST CARBIDE FIBERS THAT ARE AVAILABLE IN PREWOVEN ARCHITECTURES AND WHICH MAINTAIN HIGH STRENGTH AND CREEP RESISTANCE AT TEMPERATURES UP TO 1500 C HAVE WIDESPREAD APPLICATIONS IN ADVANCED MILITARY SYSTEMS, AEROSPACE STRUCTURES, ENGINES, ENERGY CONVERSION, CUTTING TOOLS, WEAR PARTS AND SPORTS EQUIPMENT.

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Topic#: 91-083 ID#: 9110821
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Contract #: DAAH0191CR273
PI: DONNA BOURGELAIS
Title: BROAD PROTECTION AGAINST INFECTIOUS PATHOGENS
Abstract: A METHOD IS PROPOSED FOR CONFERRING BROAD SPECTRUM IMMUNITY WITHOUT UNDESIRABLE SIDE EFFECTS. PROTECTION AGAINST A WIDE VARIETY OF BACTERIA, VIRUSES AND FUNGI ARE INCLUDED. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - IN ADDITION TO THE OBVIOUS MILITARY BENEFIT, THIS APPROACH WOULD BENEFIT IMMUNE INCOMPETENT INDIVIDUALS SUCH AS CHILDREN BORN WITH CONGENITAL IMMUNODEFICIENCIES, PATIENTS UNDERGOING BONE MARROW TRANSPLANT, ORGAN TRANSPLANT RECIPIENTS AND PATIENTS WITH AIDS.

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Topic#: 91-129 ID#: 9120587
Office: LSO
Contract #: DAAH0192CR031
PI: CLARK BRIGHT
Title: ADVANCED DEVELOPMENT OF MULTISPECTRAL TRANSMITTING E ECTRICALLY CONDUCTIVE WINDOWS
Abstract: THE DEVELOPMENT OF MULTISPECTRAL TRANSMITTING ELECTRICALLY CONDUCTIVE (EC) THIN FILM COATINGS TO SERVE AS HEATERS FOR DEICING/DEFOGGING, SHIELDS AGAINST ELECTROMAGNETIC INTERFERENCE, AND REFLECTORS TO PROVIDE A UNIFORM RADAR CROSS SECTION FOR WINDOWS IN ELECTRO-OPTICAL SYSTEMS IS PROPOSED. THE PROJECT OBJECTIVE IS TO DEVELOP A WINDOW WITH 80 - 90% TRANSMITTANCE IN BOTH THE VISIBLE AND 8 - 12 M WAVEBANDS, AND 20 OHMS/SQUARE MAXIMUM SURFACE RESISTIVITY. PREVIOUS EFFORTS TO DEVELOP MULTISPECTRAL TRANSPARENT EC COATINGS WERE BASED ON MATERIALS OPTIMIZED FOR THE VISIBLE REGION. PERFORMANCE OF THESE EC COATINGS IS NOT SATISFACTORY FOR MANY APPLICATIONS. AN INVESTIGATION OF MULTILAYER EC COATINGS IS PROPOSED. THE INVESTIGATION WOULD INCLUDE OPTICAL THIN FILM DESIGN AND VACUUM DEPOSITION OF EC AND DIELECTRIC MATERIALS. THE EC MULTILAYER OPTICAL DESIGN WOULD BE DEPOSITED ON CLEAR ZNS AND ZNSE SUBSTRATES IN AN ATTEMPT TO MEET THE PERFORMANCE OBJECTIVES. THE SUCCESSFUL DEVELOPMENT OF MULTISPECTRAL TRANSMITTING EC COATINGS WOULD ALLOW SOLUTION TO EXISTING NEEDS FOR DEICING/DEFOGGING HEATERS, EMI SHIELDS AND TRANSPARENT ELECTRODES IN EO SYSTEMS. SIMILAR FUNCTIONAL NEEDS EXISTS IN MANY COMMERCIAL APPLICATIONS.

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Phone: (805) 683-5681
Topic#: 91-087 ID#: 9120036
Office: NMRO
Contract #: DAAH0192CR085
PI: MICHAEL MESSIER
Title: ELECTROMAGNETIC METHODS FOR DETERMINING THE SIZE OF NUCLEAR UNDERGROUND EXPLOSIONS BASED ON SIGNALS RECORDED WITHIN A...
Abstract: THE OBJECTIVE OF THIS PROPOSED WORK IS TO INVESTIGATE THE MANNER IN WHICH ELECTROMAGNETIC SIGNALS EMITTED BY NUCLEAR UNDERGROUND TESTS (UGT'S) MIGHT BE USED TO DIAGNOSE THE TEST, IF THE SENSORS ARE ALLOWED TO BE WITHIN A FEW KILOMETERS OF THE SITE. THERE ARE MANY CAUSES OF EM EMISSIONS, INCLUDING CABLE CURRENTS AND ELECTROSEISMIC EFFECTS IN ADDITION TO THE OFTEN HYPOTHESIZED "MAGNETIC BUBBLE". THE COMPLICATED, AND POORLY UNDERSTOOD, NATURE OF THESE EMISSIONS MAKES IT DIFFICULT TO EXTRACT SIGNIFICANT INFORMATION, E.G., YIELD. THE ELECTROSEISMIC EFFECT OFFERS THE BEST CHANCE OF PROVIDING DIAGNOSTIC INFORMATION, PERHAPS IN CONJUNCTION WITH NORMAL SEISMIC TECHNIQUES. IF ELECTROMAGNETIC DETECTION TECHNIQUES PROVE FEASIBLE, THEY WOULD AUGMENT NORMAL SEISMIC TECHNIQUES IN THE DETERMINATION OF WEAPON YIELD, AND POSSIBLY OTHER PARAMETERS. IF THE ELECTROSEISMIC EFFECT IS SHOWN TO BE A USEFUL TOOL, THE RESEARCH CAN BE EXTENDED IMMEDIATELY TO OTHER AREAS, E.G., EARTHQUAKE DETECTION AND PROSPECTING (OIL AND MINERAL).

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Topic#: 91-139 ID#: 9120261
Office: ASTO
Contract #: DAAH0192CR086
PI: JOHN CAFARELLA
Title: LASER RF OPTICAL LINKS FOR AOTH RADAR
Abstract: THE USE OF HIGH-GAIN ANTENNA ARRAYS FOR ADVANCED OVER-THE-HORIZON (AOTH) RADAR IS COSTLY BECAUSE OF THE LARGE PHYSICAL EXTENT OF THE ARRAYS AND BECAUSE OF THE CONSTRUCTION COSTS FOR A LARGE NUMBER OF ELEMENTS, EACH REQUIRING A RECEIVER AND POWER SOURCE. MICRILOR WAS AMONG THE FIRST TO SUGGEST THE USE OF MACH/ZEHNDER INTERFEROMETERS (MZI) FOR PASSIVE TRANSDUCTION OF ANTENNA ELECTRICAL SIGNALS TO CONVEY THESE SIGNALS TO A MORE-CONVENIENT RECEIVING SITE; THIS TECHNIQUE APPEARS PROMISING FOR A VARIETY OF ANTENNA-REMOTING APPLICATIONS. FOR REMOTING RECEIVE ELEMENTS FOR A LARGE OTH APERTURE, HOWEVER, THE USE OF DIRECT-LASER MODULATION APPEARS TO OFFER ADVANTAGES OVER THE MZI APPROACH. THE PROJECTED COST OF REMOTING RECEIVE ELEMENTS USING HIGH-DYNAMIC-RANGE LASER DIODES IS ABOUT $2K PER ELEMENT, COMPARED TO ABOUT $30K PER ELEMENT USING THE MZI APPROACH. WHILE MZI LINKS ARE THUS UNLIKELY TO PROVIDE COST SAVINGS COMPARED TO STANDARD RF CABLING, THE USE OF DIRECT-LASER MODULATION FOR CONVEYING RF SIGNALS IN AOTH COULD SAVE AN ORDER OF MAGNITUDE IN COST. THE PROPOSED PROGRAM WOULD STUDY APPLICABLE APPROACHES AND EVALUATE THE MOST-PROMISING COMMERCIAL LASER DIODE. THIS WORK COULD RESULT IN MORE-GENERAL APPLICABILITY OF COMMERCIAL PHOTONICS TECHNOLOGY TO MILITARY PROGRAMS, LOWERING COSTS AND ENSURING INDUSTRIAL SOURCES. FUTURE GOVERNMENT-SPONSORED RESEARCH IN THIS AREA WOULD ALSO CONTRIBUTE TO U.S. COMPETITIVE POSTURE.

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Topic#: 91-060 ID#: 9110338
Office:
Contract #: DAAH0191CR231
PI: MAURICE FRANCOMBE
Title: NEW APPROACHES TO LONG WAVELENGTH INFRARED IMAGING DEVICES
Abstract: THE PROJECT WILL FOCUS ON THE DESIGN AND DEVELOPMENT OF A HIGH PERFORMANCE GAAS/A1GAAS MULTIQUANTUM WELL (MGW) INFRARED DETECTOR ARRAY SUITABLE FOR OPERATION IN THE 8-12 MICRON SPECTRAL RANGE. EMPHASIS WILL BE PLACED ON DETECTOR AND ARRAY FORMATS CONSISTENT WITH THE SPECIAL REQUIREMENTS OF IR STARING ARRAY IMAGERS. IN THIS PHASE WE SHALL MODEL, DESIGN, AND FABRICATE BOTH PHOTOVOLTAIC- AND PHOTOCONDUCTIVE-TYPES OF DETECTORS WITH SIGNIFICANTLY IMPROVED RESPONSIVITY, SPECTRAL BANDWIDTH, DETECTIVITY, AND UNIFORMITY. ALSO, DETECTOR STRUCTURES WILL BE DEVELOPED WITH SPECIAL COLLECTOR AND/OR EMITTER BARRIER FEATURES WHICH FACILITATE OPTIMUM STORAGE OF IR SIGNALS. IN THESE EFFORTS WE SHALL DRAW UPON THE RESULTS OF OUR CURRENTLY ACTIVE SBIR CONTRACT PROGRAMS WHICH ARE DIRECTED TOWARD VARIOUS ASPECTS OF MQW IR TECHNOLOGY. A KEY ASPECT OF OUR PROGRAM WILL BE TO EXPLORE DETECTOR AND ARRAY DESIGNS WHICH PERMIT A PULSE ADDRESS AND RESET MODE OF OPERATION THROUGH THE INCORPORATION OF INTEGRATION/STORAGE FEATURES. THIS SHOULD NOT ONLY ENSURE HIGH PERFORMANCE STARING ARRAY OPERATION, BUT ALSO MAY ENDOW THE RESULTING FOCAL PLANE STRUCTURES WITH UNIQUE RAD HARD PROPERTIES. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE QUANTUM WILL DETECTOR AND FOCAL PLANE TECHNOLOGY INNOVATIONS DEVELOPED IN THIS PROGRAM ARE EXPECTED TO HAVE A PROFOUND IMPACT ON TECHNIQUES CURRENTLY BEING EXPLORED FOR MILITARY STRATEGIC AND TACTICAL IR SYSTEMS. POTENTIAL COMMERCIAL BENEFITS SHOULD INCLUDE IMPROVED GEOLOGICAL SURVEY SENSITIVITY AND RESOLUTION, ENHANCED MULTISPECTRAL TARGET IDENTIFICATION AND DISCRIMINATION, AND MARKED PERFORMANCE GAINS FOR GROUND, AIRBORNE, AND SPACE-BASED FLIR SYSTEMS. THESE CONSTITUTE MULTI-BILLION DOLLAR MARKET AREAS.

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Topic#: 91-023 ID#: 9110671
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Contract #: DAAH0191CR303
PI: JOHN MCADOO
Title: HARDENING GALLIUM ARSENIDE MONOLITHIC MICROWAVE INTEGRATED CIRCUITS AGAINST ELECTROMAGNETIC PULSE...
Abstract: THE GOAL OF THIS PROJECT IS TO DEVELOP TECHNIQUES FOR PROTECTING GALLIUM ARSENIDE MONOLITHIC MICROWAVE INTEGRATED CIRCUITS FROM DAMAGE DUE TO THE RECEPTION OF ELECTROMAGNETIC PULSES ON THE INPUT SIGNAL LINES. PROTECTION DEVICES ARE TO BE BUILT ON TO THE MONOLITHIC CHIPS CONTAINING FRAGILE RECEIVER CIRCUITS. THE RESULTS OF DAMAGE MECHANISM STUDIES ON UNPROTECTED CIRCUITS WILL BE APPLIED TO THE DESIGN OF THESE PROTECTION DEVICES. IN THIS PROJECT, MISSION RESEARCH CORPORATION WILL STUDY THE DAMAGE MECHANISMS AND, JOINTLY WITH PACIFIC MONOLITHICS INCORPORATED, WILL DESIGN THE PROTECTION DEVICES. THE DEVICES WILL THEN BE FABRICATED BY A FOUNDRY SELECTED BY PACIFIC MONOLITHICS. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - HARDENED MONOLITHIC MICROWAVE INTEGRATED CIRCUITS WILL BE USED IN MILITARY SYSTEMS WHEREVER MICROWAVES ARE PRESENTLY EMPLOYED. THESE APPLICATIONS INCLUDE RADAR, COMMUNICATIONS, ELECTRONIC WARFARE, ELECTRONIC COUNTERMEASURES, AND IFF EQUIPMENT. IN ADDITION, THE HARDENING OF GAAS MMICS WILL MAKE PRACTICAL NEW APPLICATIONS SUCH AS PHASED ARRAY RADAR, WHICH, UNTIL NOW, HAVE BEEN TOO BULKY AND EXPENSIVE FOR FIELD USE. THERE WILL ALSO BE SPINOFFS TO THE CIVILIAN SECTOR IN CELLULAR PHONES, CABLE TV, AND APPLIANCE REMOTE CONTROL DEVICES.

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Topic#: 91-024 ID#: 9110677
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Contract #: DAAH0191CR250
PI: AMIYA CHATTERJEE
Title: NONDESTRUCTIVE EVALUATION OF STRUCTURAL DEFECTS
Abstract: QUALITY CONTROL OF COMPOSITES IS VITAL FOR THEIR SAFE USE IN VARIOUS FIELDS. THE RECENT INTRODUCTION OF A LOW COST PRESSURE SENSOR USING A FIERCE SENSITIVE RESISTOR (FSR), MAKES IT POSSIBLE TO DEVELOP A COST EFFECTIVE, REAL TIME MONITORING DEVICE FOR COMPOSITES DURING THE MANUFACTURING PHASE. THE PROPOSED CONCEPT IS BASED ON MONITORING THE PRESSURE AT SELECTED LOCATIONS WHERE IT IS INFLUENCED BY UNDESIRED ELEMENTS LIKE OVER BLEEDING, VOLATILE TRAPPING, ETC. MISSION RESEARCH CORPORATION (MRC) IS PROPOSING TO DEVELOP A REAL TIME SENSING SYSTEM FOR THE COMPOSITE MATERIAL PROPERTIES DURING CURE USING FSR. MRC WILL BE SUPPORTED BY DOUGLAS AIRCRAFT COMPANY (DAC), A COMPONENT OF THE MCDONNELL DOUGLAS CORP. (MDC) DURING ITS EXPERIMENTAL PHASE. A LOW COST (ABOUT $20 A SENSOR) PRESSURE SENSOR USING FSR WILL BE USED AS A MEANS OF IMPROVING THE QUALITY OF COMPOSITE MATERIAL AND ASSURING DEFECT FREE PRODUCT. PRESSURE SENSORS WILL BE EMBEDDED INTO CURING LAMINATES IN AN AUTOCLAVE AND THE EFFECT OF COMBINED CHANGES IN PRESSURE AND TEMPERATURE WILL BE EXAMINED. THEORETICAL AS WELL AS EXPERIMENTAL ANALYSIS WILL BE MADE TO ESTABLISH THE FEASIBILITY OF THE CONCEPT. THE EFFECT OF TEMPERATURE ON THE IN-SITU SENSOR READING WILL BE ESTABLISHED. THE EFFECT OF PROCESSING DEFECTS THAT AFFECT THE MATERIAL PROPERTIES WILL BE EXAMINED. THIS WILL INCLUDE POROSITY, RESIN RICHNESS, WRONG TYPE OF RESIN SYSTEM, VARIATIONS IN CURE CYCLE, AND LOSS OF VACUUM. EFFORTS WILL ALSO BE MADE TO IDENTIFY THE DIFFERENT STAGES OF THE CURE PROCESS: OUT GASSING, RESIN FLOW, GELATION, POST CURING, ETC.ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THIS PROPOSAL DEALS WITH THE FEASIBILITY OF USING A LOW COST PRESSURE SENSOR BASED ON FORCE SENSITIVE RESISTORS FOR REAL TIME CONTROL OF COMPOSITE MANUFACTURING.

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Topic#: 91-087 ID#: 9120648
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Contract #: DAAH0192CR084
PI: NEIL GOLDMAN

Title: BURIED MAGNETIC FIELD MEASUREMENT FOR DETERMINING THE SIZE OF UNDERGROUND NUCLEAR EXPLOSIONS

Abstract: THE GOAL OF THIS PROGRAM IS TO DETERMINE THE HYDRODYNAMIC YIELD OF UNDERGROUND TESTS USING ELECTROMAGNETIC MEANS. IN PHASE I, WE WILL STUDY AND REVIEW THE SOURCES OF ELECTROMAGNETIC EMANATIONS FROM THE DEVICE AND THE ASSOCIATED CABLING. WE WILL ALSO ANALYZE THE PROPAGATION AND INTERFERENCE EFFECTS FOR THE RECORDING OF THE SIGNALS. WE HOPE TO ESTABLISH THE FEASIBILITY OF MEASURING YIELD FROM LOW-FREQUENCY MEASUREMENTS OF THE MAGNETIC BUBBLE'S DISTORTION OF THE GEOMAGNETIC FIELD. THIS WOULD BE MEASURED AT VARIOUS DEPTHS AND RANGES COMMENSURATE WITH THE STRENGTH OF SIGNAL AND SURVIVABILITY OF THE EQUIPMENT. THESE MEASUREMENTS ARE NOT AS SENSITIVE AS SURFACE MEASUREMENTS OF B AND GENERAL MEASUREMENTS OF E TO INTERFERENCE EFFECTS AND GROUND VARIATION EFFECTS. WE WILL LOCATE AND USE THE EXISTING DATA OF EM MEASUREMENTS OF TESTS TO VALIDATE THE MODELS WE PROPOSE FROM MAGNETIC BUBBLE AND INTERFERENCE EFFECT. THIS BURIED QUASI-STATIC MAGNETIC FIELD MEASUREMENT WOULD PROVIDE AN EFFECT ADJUNCT TO THE CORRTEX/SEISMIC TECHNIQUES NOW APPLICABLE UNDER THE TEST TREATY. IT IS AN INDEPENDENT MEASUREMENT OF A PHYSICAL PHENOMENA WHICH IS RELATED TO HYDRODYNAMIC YIELD.

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Topic#: 91-062 ID#: 9110410
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PI: MARIO CAZECA

Title: NOVEL ORGANIC POLYMERS AS NONLINEAR OPTICAL MATERIALS FOR WAVELENGTH CONVERSION

Abstract: A NEW CLASS OF OPTICALLY NONLINEAR ORGANIC POLYMERS ARE PROPOSED FOR USE IN WAVELENGTH CONVERSION DEVICES. A NOVEL INVENTION ALLOWS THE CREATION OF PHASE MATCHED STRUCTURES IN THESE MATERIALS FOR IMPROVED CONVERSION EFFICIENCY. THE POLYMERS IN QUESTION WILL BE SYNTHESIZED AND SPIN-COATED ON SUITABLE SUBSTRATES AND ELECTRICALLY POLED BY THE CORONA POLING TECHNIQUE. AFTER A PROPRIETARY STABILIZATION PROCESS, BOTH LINEAR AND NONLINEAR OPTICAL PROPERTIES OF THE RESULTING FILMS WILL BE MEASURED BY STANDARD TECHNIQUES. PRELIMINARY OPTICAL MEASUREMENTS ON PROTOTYPE PHASE MATCHED DEVICES WILL ALSO BE MADE. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - IN ADDITION TO THE FUNDAMENTAL KNOWLEDGE ON NONLINEAR OPTICAL PROCESSES IN POLYMERS THAT WILL BE GAINED THROUGH THIS STUDY, SIGNIFICANT PRACTICAL BENEFITS ARE EXPECTED TO FOLLOW. DUE TO THE COMPATIBILITY OF THE PROPOSED INVENTION WITH PLANAR SEMICONDUCTOR FABRICATION, WAVELENGTH CONVERSION DEVICES OF THIS TYPE SHOULD FIND WIDE APPLICATION IN BOTH DISCRETE EMITTER FREQUENCY DOUBLER SYSTEMS AND INTEGRATED OPTICAL CIRCUITS AND SUBSYSTEMS.

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Topic#: 91-033 ID#: 9110637
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Contract #: DAAH0191CR251
PI: V. DORFMAN

Title: X-RAY MASK FABRICATION USING "DIAMOND POLYMER FILMS" (DPF) MEMBRANES AND W-ALLOYED DPF ABSORBERS

Abstract: THIN FILM STRUCTURES BASED ON A NOVEL CLASS OF PREDOMINANTLY AMORPHOUS CARBON FILMS, TERMED, DIAMOND POLYMER FILMS (DPF) CAN BE UTILIZED FOR THE FORMATION OF X-RAY MASKS. LIKE DIAMONDLIKE FILMS, THESE FILMS ARE EXTREMELY HARD, AND POSSESS X-RAY AND OPTICAL TRANSPARENCY. UNLIKE HIGHLY STRESSED, DIAMONDLIKE FILMS, THE STRESS LEVEL IN THESE DPF FILMS CAN BE CONTROLLED (FROM HIGHLY STRESSED TO STRESS-FREE) BY APPROPRIATE ADDITIONS

OF ELEMENTS LIKE SILICON DURING THE DEPOSITION. FURTHER, THESE FILMS CAN BE ALLOYED WITH METALLIC ELEMENTS LIKE W TO PRODUCE STRESS-FREE W-DPF FILMS. THESE STRESS-FREE, DPF FILMS CAN BE ""SEAMLESS"LY GROWN ONTO UNALLOYED DPF FILMS AND ACT AS X-RAY ABSORBERS TO FORM X-RAY AND OPTICALLY TRANSPARENT, MECHANICALLY STIFF, DIMENSIONALLY CONFORMED X-RAY MASKS FOR THE NEXT GENERATION OF IC TECHNOLOGIES. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS- THE FORMATION OF GOOD MASK TECHNOLOGY USING DPF FILMS WILL REMOVE ONE OF THE MAJOR OBSTACLES TO COMMERCIAL UTILIZATION OF X-RAY LITHOGRAPHY FOR THE FORMATION OF ULTRA FINE FEATURES LEADING TO THE NEXT GENERATION OF IC TECHNOLOGY.

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Topic#: 91-101 ID#: 9121223
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Contract #: DAAH0192CR075
PI: TERJE SKOTHEIM

Title: NEW HIGH CONDUCTIVITY POLYMER ELECTROLYTES WITH EXCLUSIVE CATION CONDUCTIVITY

Abstract: CURRENTLY, THERE IS A NEED TO IMPROVE THE TECHNOLOGY FOR EFFICIENT AND ECONOMICAL GENERATION AND STORAGE OF ELECTRICAL POWER. TO FURTHER THIS OBJECTIVE, NEW POLYMER SOLID ELECTROLYTES ARE NEEDED TO ADVANCE A BROAD CLASS OF ELECTROCHEMICAL ENERGY SYSTEMS. FOR RECHARGEABLE BATTERIES, IT WOULD BE ADVANTAGEOUS TO HAVE EXCLUSIVE CATIONIC MOBILITY, SINCE THE ANION DOES NOT PARTICIPATE IN THE ELECTROCHEMICAL PROCESSES AT THE ELECTRODES, BUT DOES PROVIDE DELETERIOUS LOCAL CONCENTRATION GRADIENTS WHICH GENERATE OPPOSING VOLTAGES. THE RESULT IS REDUCED POWER OUTPUT. A SPECIFIC CATION CONDUCTOR WOULD LEAD TO SUBSTANTIALLY HIGHER POWER OUTPUT FROM THE CELL. THE SPECIFIC TECHNICAL OBJECTIVE OF THE PHASE I RESEARCH EFFORT IS TO SYNTHESIZE NEW SOLID POLYMER ELECTROLYTES WITH HIGH SPECIFIC LITHIUM ION CONDUCTIVITY AT ROOM TEMPERATURE. IN ADDITION, NEW POLYMERIZATION PROCESSES FOR POLYMER ELECTROLYTES WILL BE DEVELOPED, WHICH WILL RESULT IN THE FABRICATION OF PINHOLE-FREE POLYMER ELECTROLYTE FILMS THINNER THAN HAS PREVIOUSLY BEEN CONSIDERED, WHICH WILL SUBSTANTIALLY ENHANCED THE CHARGE STORAGE CAPACITY OF LITHIUM/POLYMER ELECTROLYTE BATTERIES. IF SUCCESSFUL, THIS PROGRAM WILL PROVIDE SOLID POLYMER ELECTROLYTES FOR A NEW GENERATION OF ADVANCED RECHARGEABLE LITHIUM BATTERIES WITH LONG LIFE AND HIGH ENERGY STORAGE CAPACITY.

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Topic#: 91-222 ID#: 9120315
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Contract #: DAAH0192CR052
PI: WILLIAM JOSEPH TAYLOR

Title: SIMULATION OF HIGH STRAIN RATES FOR OPTICAL FIBER

Abstract: ESSENTIAL TO THE SUCCESS OF FIBER OPTIC GUIDED MISSILE SYSTEMS IS THE LONG TERM RELIABILITY AND COST OF THE FIBER OPTIC DISPENSER. AN ACCURATE KNOWLEDGE OF THE STRESS STATES THAT OCCUR DURING WINDING, STORAGE AND PAYOUT IS ESSENTIAL TO OPTIMIZATION. THE ADHESIVE EXPERIENCES EXTREMELY HIGH STRAIN RATES DURING PAYOUT, AND THE BEHAVIOR OF EXISTING ADHESIVES UNDER THESE STRAIN RATES IS NOT KNOWN. FURTHERMORE, AT PRESENT WE CANNOT SPECIFY THE DESIRED HIGH STRAIN RATE ADHESIVE TO MINIMIZE FIBER BENDING STRESS DURING PAYOUT. THE FOCUS IS ON THE DEVELOPMENT OF A COST-EFFECTIVE METHOD FOR OBTAINING THE NECESSARY HIGH STRAIN RATE DATA AND THE GENERATION OF PAYOUT MODELS NECESSARY TO PERFORM OPTIMIZATION. PRIMARY EMPHASIS IS ON THE ADHESIVE RUPTURE CHARACTERISTICS AND FIBER PEEL POINT DYNAMICS DURING PAYOUT TO OBTAIN AN ACCURATE DESCRIPTION OF ADHESIVE FORCE DISTRIBUTION AT THE PEEL POINT, WHICH WILL ALLOW A MORE ACCURATE DESCRIPTION OF THE STRESS STATE OF THE FIBER DURING PAYOUT, SINCE THIS CONCERN REPRESENTS ONE OF THE MAJOR DIFFICULTIES IN THE FOG-V TECHNOLOGY DEVELOPMENT PROGRAM. THE MRC TEAM PERCEIVES THIS TO BE THE MOST PROMISING APPROACH TO OBTAINING THE NEEDED UNDERSTANDING OF THE ADHESIVE AND FIBER DURING PAYOUT IN THE MOST EXPEDIENT TIME FRAME POSSIBLE. THE ANALYSIS, MODELING AND

TESTING PROPOSED WILL RESULT IN A GREAT IMPROVEMENT OVER EXISTING MODELS AND WILL PROVIDE THE BASIS FOR IMPROVED SPECIFICATIONS FOR FIBER, ADHESIVE AND BUFFER MATERIALS. THIS WILL ALSO ALLOW FIBER COST REDUCTION BY ADJUSTING THE FIBER PROOF TEST REQUIREMENTS TO THE PREDICTED PEEL POINT STRESS, ULTIMATELY LEADING TO THE DEVELOPMENT OF OPTIMIZED BUFFER COATINGS AND ADHESIVES.

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Topic#: 91-151 ID#: 9120693
Office: ASTO
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Title: A SOFTWARE ARCHITECTURE FOR DEVELOPING AGGREGATE INTELLIGENCE SUMMARIES

Abstract: WHILE INTELLIGENCE INFORMATION IS CRUCIAL TO ALL DECISION ANALYSIS AND OPERATIONS EVALUATION, ITS COLLECTION AND ANALYSIS HAS BECOME A DEMANDING TASK. RECENT YEARS HAVE SEEN AN INCREASE IN THE AMOUNT AND SCOPE OF FIRST LEVEL INTELLIGENCE PRODUCTS WHILE THE TIME AVAILABLE FOR ANALYSIS AND DECISION MAKING HAS DECREASED. A COMPUTERIZED SYSTEM CAPABLE OF CREATING ANALYTICAL INTELLIGENCE REPORTS FROM FIRST LEVEL INTELLIGENCE PRODUCTS WOULD GREATLY ASSIST DECISION MAKERS. PAST EFFORTS TO CREATE COMPUTERIZED SYSTEMS HAVE BEEN HINDERED BY THE DIFFICULTY IN EVALUATING INTELLIGENCE HYPOTHESES IN THE LIGHT OF UNCERTAIN OR MISSING EVIDENCE. MRJ AND GEORGE MASON UNIVERSITY (GMU) PROPOSE AN INNOVATIVE SYSTEM THAT COMBINES STATE OF THE ART PROBABILISTIC INFERENCE TECHNIQUES WITH SYMBOLIC KNOWLEDGE-BASED TECHNIQUES. PROBABILISTIC INFERENCE METHODS HAVE BEEN SHOWN TO BE WELL SUITED TO EVALUATING HYPOTHESES WITH UNCERTAIN OR MISSING EVIDENCE. RECENT RESEARCH HAS DEMONSTRATED THAT KNOWLEDGE-BASED TECHNIQUES CAN BE USED TO CREATE THE PROBABILISTIC MODELS NECESSARY FOR PROBABILISTIC METHODS TO PERFORM THEIR ANALYSIS. A SYSTEM COMBINING THESE TWO TECHNOLOGIES COULD AGGREGATE FIRST LEVEL INTELLIGENCE TO DEVELOP AND TEST PLAUSIBLE INTELLIGENCE HYPOTHESES AND CREATE ANALYTICAL INTELLIGENCE REPORTS. THE RESULTING SYSTEM WILL GREATLY ENHANCE OUR ABILITY TO ANALYZE FIRST LEVEL INTELLIGENCE PRODUCTS. THE SYSTEM DESCRIBED WOULD LOWER THE HUMAN LABOR REQUIRED TO COLLECT FIRST LEVEL INTELLIGENCE AND GENERATE SUMMARIES. IT WOULD MAKE THESE REPORTS MORE AVAILABLE TO DECISION MAKERS, ESPECIALLY IN TIME CRITICAL SITUATIONS. THIS SYSTEM COULD EITHER LOWER THE COSTS OF WAR GAME SIMULATIONS OR THE COST SAVINGS COULD BE REDIRECTED INTO CREATING MORE DETAILED SIMULATIONS. THE BASIC TECHNOLOGY COULD BE SUPPLIED DIFFERENT DOMAIN KNOWLEDGE TO CREATE COMMERCIAL APPLICATIONS.

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Topic#: 91-070 ID#: 9110202
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Contract #: DAAH0191CR239
PI: GARY CHIN

Title: NOVEL PROCESSES FOR CHEMICAL VAPOR INFILTRATION OF STRUCTURAL CERAMIC COMPOSITES

Abstract: THE PROPOSED PHASE I RESEARCH WILL EXAMINE TWO NOVEL PROCESSES FOR IMPROVING THE UNIFORMITY AND DENSITY OF CERAMIC MATRIX CHEMICAL VAPOR INFILTRATION (CVI). BOTH METHODS INVOLVE THE UNIFORM SELECTIVE DEPOSITION OF MATRIX MATERIAL STARTING AT THE FIBER MATRIX INTERFACE. ONE TECHNIQUE INVOLVES THE DEPOSITION OR ADDITION OF MATERIAL, ON THE FABRIC PREFORM, WHICH WILL SELECTIVELY COUPLE TO AN RF INDUCTION POWER SUPPLY. THIS SELECTIVE COUPLING SHOULD CAUSE LOCAL HEARING AND HENCE LOCAL DEPOSITION OF THE MATRIX MATERIAL. THE SECOND IMPROVED CVI PROCESS INVOLVES COATING OF MATERIALS, ON THE FABRIC PREFORM, WHICH WILL CATALYZE THE FORMATION OF THE MATRIX MATERIAL. THIS WILL ALLOW DEPOSITION OF THE MATRIX MATERIAL TO OCCUR AT LOWER TEMPERATURES AND THUS AVOID SOME OF THE UNDESIRABLE PREFERENTIAL SURFACE PORE CLOSURES WHICH INHIBIT COMPOSITE DENSIFICATION. THE PHASE I EFFORT WILL EVALUATE COMPOSITES FABRICATED BY BOTH OF THESE PROCESSES. EVALUATIONS WILL INCLUDE MICROSTRUCTURAL EXAMINATIONS AS WELL AS ROOM TEMPERATURE STRENGTH AND

TOUGHNESS MEASUREMENTS OF COMPOSITES MADE WITH THE MOST PROMISING ADDITIVES. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE PROPOSED IMPROVED CVI PROCESSES SHOULD LOWER PROCESSING COSTS FOR CIV INFILTRATED COMPOSITES. THESE LOWER COSTS WOULD RESULT FROM FEWER STEPS IN THE CVI PROCESS AND FEWER POST CVI PROCESSING STEPS TO FORM NET SHAPE COMPOSITES. THESE POTENTIAL ADVANTAGES OF THESE CVI PROCESSES MAKE THEM POTENTIALLY ATTRACTIVE PROCESSES FOR CERAMIC MATRIX COMPOSITE COMPONENT PRODUCTION FOR ENGINE AND AIRFRAME COMPONENTS.

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Phone: (415) 940-1225
Topic#: 91-033 ID#: 9110791
Office:
Contract #: DAAH0191CR308
PI: ALEX SHIMKUNAS
Title: MULTILAYER MEMBRANES FOR X-RAY LITHOGRAPHY MASKS
Abstract: MULTILAYER COATINGS CONSTRUCTED OF MATERIALS OF LOW ATOMIC NUMBER WILL BE USED TO MAKE MEMBRANES FOR X-RAY LITHOGRAPHY MASKS. THE MULTILAYER MEMBRANES WILL THEN BE EVALUATED WITH RESPECT TO SUCH BENEFITS AS INCREASED OPTICAL TRANSMITTANCE FOR MASK ALIGNMENT,INCREASED WET ETCH RESISTANCE DURING MEMBRANE FABRICATION, IMPROVED STRESS CONTROL, INCREASED FRACTURE STRENGTH AND GREATER MEMBRANE SMOOTHNESS FOR IMPROVED PATTERNABLITY. THE COATING AND MEMBRANE DEVELOPMENT EFFORT WILL BE APPLIED TO MULTILAYER COMBINATIONS OF SILICON CARBIDE,SILICON NITRIDE, SILICON DIOXIDE, AND DIAMOND. AN ELECTRON CYCLOTRON RESONANCE CHEMICAL VAPOR DEPOSITION (ECR CVD) SYSTEM WILL BE USED TO DEPOSIT ALL THE LAYERS COMPRISING THE MULTILAYER COATINGS. THE ECT CVD COATING TECHNOLOGY HAS ALREADY BEEN SUCCESSFULLY APPLIED TO DEVELOPING SILICON CARBIDE MEMBRANES FOR X-RAY MASKS, AND ALL THE PROPOSED LAYERING MATERIALS HAVE BEEN TESTED AND DEVELOPED IN THE ECR CVD SYSTEM.THE REPRODUCIBILITY OF THE ECT CVD COATING PROCESS IS BETTER THAN 1%,MAKING THIS A PROMISING COMMERCIAL PROCESS FOR MANUFACTURING MULTILAYER COATINGS REQUIRING CONTROLLED LAYER THICKNESSES. THE INTEGRATION OF MULTILAYER MEMBRANES WITH THE REST OF THE X-RAY MASK MAKING PROCESS WILL BE FULLY EVALUATED. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - ADVANCED AND IMPROVED X-RAY LITHOGRAPHY MASKS. THE KEY BENEFITS FOR MASKS ARE: IMPROVED MASK ALIGNMENT, IMPROVED PATTERNABILITY, AND HIGHER MANUFACTURING YIELDS. ALSO, IMPROVED X-RAY WINDOWS AND FILTERS HAVING GREATER BURST STRENGTH.

NAVSYS CORP.
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Topic#: 91-242 ID#: 9120569
Office: ASTO
Contract #: DAAH0192CR010
PI: ALISON BROWN
Title: LOW COST, PORTABLE AUTOMATIC LANDING SYSTEM FOR UNMANNED AUTONOMOUS VEHICLES
Abstract: CURRENTLY, THE LANDING REQUIREMENTS OF CLOSE-RANGE, SHORT-RANGE, AND MEDIUM-RANGE UAVS PLACE OPERATIONAL LIMITS ON THEIR USE. A LOW COST, PORTABLE, PRECISION APPROACH AND LANDING SYSTEM IS DESCRIBED IN THIS PROPOSAL WHICH USES THE GLOBAL POSITIONING SYSTEM (GPS). TO BE VIABLE AS A PRECISION APPROACH SYSTEM, GPS MUST BE CAPABLE OF PROVIDING AN ACCURACY OF BETTER THAN 9.1 METERS IN AZIMUTH AND 3 METERS IN ELEVATION WITH A RELIABILITY APPROACHING 100%. A POSITIVE INDICATION THAT THE SYSTEM IS WITHIN TOLERANCE IS ALSO REQUIRED. A PRECISE POSITIONING AND INTEGRITY MONITORING TECHNIQUE IS DESCRIBED IN THIS PROPOSAL WHICH CAN MEET THESE REQUIREMENTS. A REAL-TIME PRECISE POSITIONING TECHNIQUE IS DESCRIBED WHICH PROVIDES THE CAPABILITY FOR DECIMETER LEVEL POSITIONING. AN AUTONOMOUS INTEGRITY ALGORITHM IS ALSO DESCRIBED WHICH PROVIDES A REAL-TIME CHECK ON THE VALIDITY OF THE GPS DATA. THIS ALGORITHM IS CAPABLE OF DETECTING WHENEVER THE GPS SOLUTION EXCEEDS THE PRECISION APPROACH REQUIREMENTS WITHIN A TIME-TO-ALARM OF 2 SECONDS. THE PERFORMANCE OF THE PROPOSED LANDING SYSTEM WILL BE DEMONSTRATED UNDER THE PHASE I CONTRACT THROUGH

SIMULATION. A PHASE II SYSTEM DESIGN WILL BE DEVELOPED THAT IS SUITABLE FOR INTEGRATING INTO AN EXISTING UAV AND CONTROL STATION. UNDER PHASE II, A PROTOTYPE SYSTEM SUITABLE FOR FLIGHT TESTING WILL BE INTEGRATED INTO A UAV AND FLIGHT TESTED. THE PROPOSED SYSTEM WILL PROVIDE A WORLD-WIDE CAPABILITY FOR A PORTABLE PRECISION UAV LANDING SYSTEM AT A FRACTION OF THE COST OF ILS AND MLS LANDING SYSTEMS. THE SYSTEM WILL ALSO HAVE APPLICATIONS AS A PRECISION APPROACH AND LANDING SYSTEM FOR MANNED AIRCRAFT.

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Topic#: 91-113
Office: MTO
Contract #: DAAH0192CR091
PI: JAMES JOHNSON
ID#: 9120769

Title: REAL TIME PROCESS CONTROL USING NEURAL NETWORKS

Abstract: THIS PROJECT WILL DEMONSTRATE THE FEASIBILITY OF USING NEURAL NETWORKS TO CONTROL MAGNETIC BEARINGS TO SUPPORT A LEVITATED, FRICTIONLESS ROTATING SHAFT. NEURAL NETWORK CONTROLLERS WILL BE DESIGNED TO PROVIDE THE DYNAMIC CONTROL NECESSARY TO ALLOW A SHAFT SUPPORTED BY A MAGNETIC BEARINGS TO SPIN UP AND SPIN DOWN THROUGH ITS RESONANCE FREQUENCIES. NEURAL NETS WILL PROVIDE DYNAMIC SHAFT DAMPING FOR TRANSIENT RESONANT MOMENTS THAT RENDER CURRENT CONTROL TECHNIQUES IMPRACTICAL. THIS WORK WILL DEMONSTRATE IN A LARGER SENSE THE ABILITY OF NEURAL NETS TO IMPLEMENT OPERATIVE REPLACEMENTS FOR DIGITAL FILTER CONTROLLERS WITHOUT THE REQUIREMENT FOR EXTENDED DEVELOPMENT PROCESSES. THE ALGORITHMS DEVELOPED WILL EMULATE THE PERFORMANCE OF CONVENTIONALLY USED DIGITAL SIGNAL PROCESSING ALGORITHMS, SUCH AS THE INFINITE IMPULSE RESPONSE (IIR) FILTER. STATIC SHAFT LEVITATION AND SIMPLE DYNAMIC CONTROL WILL BE DEMONSTRATED DURING PHASE I TO SHOW FEASIBILITY. IN PHASE II A GENERAL PURPOSE ACTIVE CONTROL SYSTEM WILL BE CONFIGURED AND TESTED, WHICH PROVIDES ADAPTIVE DYNAMIC CONTROL AND EXHIBITS ADAPTIVE LEARNING AND RESPONSE TO LONG TERM CHANGES IN THE STATIC AND DYNAMIC CHARACTERISTICS OF THE SYSTEM. POTENTIAL APPLICATIONS INCLUDE CONTROL OF ANTI-MATTER FOR ROCKET FUEL, CONTROL OF MAGNETS FOR FUSION REACTORS, AND SEPARATION OF IMPURITIES FROM SEA WATER IN DIFFERENTIAL-VORTEX DESALINATION PLANTS. IT WILL ALLOW EXTREMELY PRECISE POSITIONING OF CUTTING TOOLS VIA NEURAL NETWORK CONTROL OF NON-LINEAR PIEZO MICROPOSITIONERS. THIS TECHNOLOGY WILL BOOST RELIABILITY THROUGH REMOVAL OF IMPERFECTIONS WHICH LEAD TO FAILURE AND WILL ELIMINATE EXCESS WEIGHT WHICH IS DESIGNED INTO PRODUCTS TO PROVIDE MARGINS OF SAFETY FOR UNKNOWN PART-OUT-OF-TOLERANCE CONDITIONS.

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Topic#: 91-181
Office: ESTO
Contract #: DAAH0192CR011
PI: GREGORY DIEHL
ID#: 9120095

Title: RAPID MODELING, SCHEDULING, AND REAL-TIME CONTROL OF SEMICONDUCTOR FACTORIES

Abstract: THIS PROPOSAL RESPONDS TO THE STATED GOALS OF DARPA SBIR TOPIC 91-181 BY PROPOSING THREE NOVEL APPROACHES: (A) DEVELOP RAPID MODELING TECHNOLOGY (RMT) TOOLS FOR DESIGN, PLANNING, AND DECISION SUPPORT OF SEMICONDUCTOR FACTORIES, (B) RECOGNIZING THE MULTIPRODUCT COMPLEXITY IN SEMICONDUCTOR MANUFACTURING, DEVELOP SCHEDULING TOOLS BASED ON LAGRANGIAN RELAXATION TECHNIQUES WITH SIGNIFICANT POTENTIAL ADVANTAGES OVER EXISTING HEURISTIC APPROACHES, AND (C) TAKING ADVANTAGE OF NOVEL ON-LINE SENSITIVITY ANALYSIS APPROACHES, DEVELOP REAL-TIME CONTROL MECHANISMS DRIVEN BY ACTUAL REAL-TIME FACTORY DATA; THESE MECHANISMS CAN OBTAIN ANSWERS TO A LARGE NUMBER OF "WHAT-IF" QUESTIONS ALL IN PARALLEL, AND HENCE RAPIDLY IDENTIFY (ON LINE) OPTIMAL PARAMETER SETTINGS OR OPERATING POLICIES. IN ALL CASES, OUR PHASE I GOAL IS TO ESTABLISH FEASIBILITY OF THESE NOVEL APPROACHES THROUGH EXPLICIT DEMONSTRATIONS OF PROTOTYPE SOFTWARE TOOLS. WE ANTICIPATE THAT THE SUCCESSFUL COMPLETION OF THE PROPOSED PHASE I EFFORT WILL (A) LEAD TO THE DEVELOPMENT OF

EASY-TO-USE COMMERCIAL SOFTWARE TOOLS FOR RAPID MODELING, DESIGN, AND SCHEDULING OF SEMICONDUCTOR FACTORIES, (B) FIND EXTENSIONS TO OTHER MODERN MANUFACTURING ENVIRONMENTS, (C) INITIATE A RADICAL NEW APPROACH FOR REAL-TIME CONTROL OF FACTORY OPERATIONS THROUGH THE USE OF ACTUAL DATA, (D) LEAD TO A NOVEL WAY OF BUILDING DISCRETE EVENT SIMULATION TOOLS WITH INHERENT MASSIVELY PARALLEL PARAMETRIC ANALYSIS CAPABILITIES. THUS, A BYPRODUCT OF THIS PROJECT WILL BE A CONTRIBUTION TOWARDS SOLVING ONE OF THE MAJOR PROBLEMS IDENTIFIED IN THE 1990 DOD LIST OF CRITICAL TECHNOLOGIES (#5 SIMULATION AND MODELING).

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Topic#: 91-075 ID#: 9110448
Office:
Contract #: DAAH0191CR292
PI: THOMAS JONES
Title: ASSESSMENT OF MATERIALS, STRUCTURES, AND COMPONENT DEVELOPMENT USING ADVANCED COMBAT MODELS
Abstract: THE PROPOSED PHASE I EFFORT WILL EXAMINE CURRENT COST-BENEFIT ANALYSIS TECHNIQUES. FROM THIS REVIEW, A METHOD WILL BE DEVELOPED, WHICH WILL INCORPORATE THE RESULTS FROM ADVANCED COMBAT SIMULATIONS TO PERFORM A TRUE COST BENEFIT ANALYSIS. A HYPOTHETICAL WEAPON SYSTEM WILL BE EVALUATED YIELDING A FINAL "FIGURE OF MERIT" (FOM) AND DEMONSTRATING THE ABILITY TO USE WARGAMING RESULTS TO PERFORM COST-BENEFIT EVALUATIONS OF ADVANCED MATERIALS, STRUCTURES, AND COMPONENTS IN MODERN WEAPON SYSTEMS. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - AN ANTICIPATED BENEFIT IS THE DEMONSTRATION OF A COST-EFFECTIVE METHOD FOR EVALUATING NEW MATERIALS, STRUCTURES, AND COMPONENTS IN BATTLEFIELD SITUATIONS BEFORE SUCH AN ENHANCEMENT IS DEVELOPED.

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Topic#: 91-195 ID#: 9121038
Office: CSTO
Contract #: DAAH0192CR210
PI: ANURAG GUPTA
Title: INTEROPERABLE DESIGN ADVISOR TOOLS FOR THE REDUCTION OF ELECTRONIC SYSTEM LIFE CYCLE COST
Abstract: THE INCREASING COMPLEXITY AND DENSITY OF ELECTRONIC SYSTEM DESIGNS COMBINED WITH A PROLIFERATION OF COMPONENT TECHNOLOGIES AND CHOICES HAS CREATED AN URGENT NEED FOR A TOOL THAT ENABLES DESIGN PERFORMANCE OPTIMIZATION TO TARGET CRITERIA (E.G. SPEED POWER, DENSITY, AREA, COST, RELIABILITY). WHILE COMMERCIAL TOOLS ARE AVAILABLE FROM SYNOPSYS AND OTHERS FOR THIS PURPOSE FOR DEVICE LEVEL DESIGN (E.G. ASICS, CUSTOM ICS), NO SUCH TOOLS ARE AVAILABLE FOR MULTI-DEVICE SYSTEM-LEVEL DESIGN. IN ADDITION, THE CAE/CAD TOOLS AVAILABLE TODAY ONLY AUTOMATE THE BACK-END OF THE DESIGN PROCESS: SCHEMATIC CAPTURE, SIMULATION, PCB LAYOUT; THEY DO NOT SUPPORT DESIGN OPTIMIZATION AT THE FRONT-END OF THE DESIGN PROCESS WHERE MUCH OF THE PRODUCT LIFE-CYCLE COST IS DETERMINED. BASED ON THEIR EIGHT YEARS OF PRIOR WORK IN THIS AREA, REPRESENTED BY OVER 20 PUBLICATIONS, OMNIVIEW'S PROJECT TEAM MEMBERS HAVE DEVELOPED THE CONCEPT OF A DESIGN SPACE EXPLORATION TOOL AS THE PERFORMANCE OPTIMIZATION TOOL MOST LIKELY TO SUCCEED FOR TECHNOLOGY-INDEPENDENT DESIGN SYNTHESIS. THIS APPROACH IS DERIVED FROM TWENTY MAN-YEARS OF PRIOR DEVELOPMENT AND PROTOTYPING WORK BY THE TEAM MEMBERS ON MICON, AN ADVANCED DESIGN & SYNTHESIS SYSTEM THAT AUTOMATES THE FRONT-END OF THE DESIGN PROCESS: CONCEPT DESIGN, PARTITIONING, COMPONENT SELECTION, AND DESIGN INTEGRATION AND RE-USE. OMNIVIEW HAS BEEN GRANTED AN EXCLUSIVE LICENSE TO MICON TECHNOLOGY BY CARNEGIE MELLON UNIVERSITY. THE PROPOSED TOOL WILL ENABLE DESIGNERS TO WORK AT THE FUNCTIONAL BLOCK LEVEL, INDEPENDENT OF COMPONENT SELECTION OR DEVICE TECHNOLOGY; ENABLE BOTH STRUCTURE-PRESERVING AND REQUIREMENT-PRESERVING EXPLORATION, EITHER USER-DIRECTED OR AUTOMATIC; AND ALLOW PERFORMANCE OPTIMIZATION TO THE TARGET CRITERIA. PHASE I TECHNICAL OBJECTIVES INCLUDE FEASIBILITY

DEMONSTRATION OF THE CONCEPT OF DESIGN-BY-FUNCTIONAL BLOCKS, DEVELOPMENT OF THE ARCHITECTURE AND SPECIFICATIONS OF THE DESIGN SPACE EXPLORATION TOOL BASED ON A RETIREMENT AND ENHANCEMENT OF PREVIOUS WORK, AND DEFINITION OF THE INTERFACES TO FAMILIES OF DEVICE TECHNOLOGIES AND CAE/CAD FRAMEWORKS, LEADING TO A PHASE II IMPLEMENTATION AND DEMONSTRATION PLAN.

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Topic#: 91-084 ID#: 9120509
Office: NMRO
Contract #: DAAH0192CR076
PI: BRAHM RHODES

Title: TECHNOLOGIES FOR VISUALIZATION OF COMPLEX TECHNICAL PROCESSES AND NOVEL APPROACHES FOR PRESENTING/DISPLAYING SUCH INFORM

Abstract: THE OBJECTIVE OF THE PROPOSED PROGRAM IS TO INVESTIGATE AND DEVELOP VISUALIZATION TOOLS THAT ADDRESS THE SPECIAL REQUIREMENTS OF LARGE-SCALE COMPUTING. EFFICIENT ANALYSIS OF LARGE, MULTI-DIMENSIONAL DATABASES CONSISTING OF SEISMIC DATA REQUIRES THE INTERACTIVE USE OF HIGH PERFORMANCE GRAPHIC TOOLS. PROCESSING SEISMIC DATA TO PRODUCE GRAPHIC IMAGES PRODUCES A QUANTITY OF INFORMATION ON THE ORDER OF MEGABYTE PER IMAGE, WHILE LARGE-SCALE DATABASES ARE ON THE ORDER OF A GIGABYTE. THIS SEVERAL ORDER OF MAGNITUDE DIFFERENCE PRODUCES A SEVERE BOTTLENECK WHEN USING EXISTING GRAPHICS WORKSTATIONS TO GENERATE IMAGES. THIS PROBLEM IS WORSENED WHEN TIME-DEPENDENT CALCULATIONS OR DATA ARE VISUALIZED, SINCE IN THESE CASES LARGE AMOUNTS OF DATA MUST BE TRANSFERRED AND RENDERED REPETITIVELY. RENDERING VARIOUS TYPES OF DATA, SUCH AS VOLUMETRIC DATA, CAN ALSO POSE MAJOR DIFFICULTIES SINCE CURRENT ALGORITHMS ARE COMPUTATIONALLY INTENSIVE, REQUIRES A LARGE AMOUNT OF MEMORY AND ARE BEYOND THE CURRENT LEVEL OF PERFORMANCE OF GRAPHIC WORKSTATIONS. HIGH PERFORMANCE RENDERING TOOLS CONSISTING OF THOROUGHLY INTEGRATED SOFTWARE AND HARDWARE NEED TO BE DEVELOPED. THESE TOOLS ARE THEN INCORPORATED INTO A COMPLETE VISUALIZATION ENVIRONMENT (VE) CONSISTING OF THOROUGHLY INTEGRATED SUPERCOMPUTER AND/OR SPECIAL PURPOSE GRAPHICS HARDWARE AND SOFTWARE. THIS VE WILL PROVIDE THE REQUIRED ADVANCED VISUALIZATION CAPABILITIES, MINIMIZE DATA TRANSFER BANDWIDTH, AND ACHIEVE A PROPERLY BALANCED COMPUTATION LOAD AMONG THE VARIOUS SYSTEMS INVOLVED. THE PROPOSED PROGRAM IS AIMED AT DEVELOPING HIGH PERFORMANCE RENDERING TOOLS FOR SCIENTIFIC VISUALIZATION OF SEISMIC DATA. THESE TOOLS REQUIRE IMPLEMENTATION ON SUPERCOMPUTERS AND/OR SPECIAL PURPOSE GRAPHICS BOARDS. THE PROPOSED TOOLS WILL PROVIDE RESEARCHERS, DESIGNERS AND OTHER USERS AN EFFICIENT MEANS TO INTERACTIVELY ANALYZE LARGE MULTI-DIMENSIONAL SEISMIC DATABASES. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - EARTHQUAKE DETECTION AND PREDICTION, OIL EXPLORATIONS, NUCLEAR TESTING DETECTION.

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Topic#: 91-161 ID#: 9120953
Office: ESTO
Contract #: DAAH0192CR198
PI: RICHARD KIM

Title: FLAT PANEL LAMP BASED ON ORGANIC POLYMER HETEROSTRUCTURE FOR LCD BACKLIGHT

Abstract: OPTICAL SENSOR TECHNOLOGY PROPOSES TO DEVELOP HIGH LUMINOUS OUTPUT AND HIGH EFFICIENCY FLAT PANEL LAMPS FOR USE AS DISPLAY BACKLIGHT SOURCES. THE PROPOSED DEVICE IS BASED ON HIGH FLUORESCENCE QUANTUM EFFICIENCY ORGANIC POLYMERS AND A NEW ORGANIC SEMICONDUCTOR HETEROSTRUCTURE TO OBTAIN A VERY BRIGHT AND LARGE AREA LIGHT EMITTING SOURCE. THIS DEVICE HAS A POTENTIAL TO OFFER THE USEFUL LIGHT OUTPUT RIVALING THOSE OF FLUORESCENT BACKLIGHTS WITH THE DESIRABLE STRUCTURAL PROPERTIES SIMILAR TO THOSE OF ELECTOLUMINESCENT (EL) LAMPS. FURTHERMORE, THE NEW LAMP OFFERS LOW OPERATION VOLTAGE (< 20 VDC), AND THE MATERIAL CAN BE COATED ON SUITABLE SUBSTRATES AT LOW TEMPERATURES WITHOUT THE RISK OF DAMAGING ELECTRONIC COMPONENTS. MANY ORGANIC POLYMERS ARE NOW

AVAILABLE IN THE VISIBLE SPECTRUM (INCLUDING BLUE), AND CERTAIN ORGANIC POLYMERS, SUCH AS CONJUGATED POLYMERS, HAVE BEEN COATED ON LARGE SUBSTRATES AND PROCESSED INTO STABLE AND GOOD STRUCTURAL THIN FILMS. THE THREE LAYER HETEROSTRUCTURE, WHERE THE EMISSIVE LAYER IS SANDWICHED BETWEEN ELECTRON AND HOLE TRANSPORT LAYERS, WILL ACHIEVE HIGH EFFICIENCY. THE FLAT PANEL LAMPS DEVELOPED UNDER THIS PROGRAM CAN BE EASILY INTEGRATED INTO FULL COLOR BACK-LIT LCDS. THE RESULTING SYSTEMS WOULD BE BRIGHTER AND LOWER POWER CONSUMPTION AS WELL AS SMALLER (LESS BULKY). CRITICAL MILITARY AND COMMERCIAL PORTABLE APPLICATIONS WOULD BENEFIT GREATLY FROM SUCH EFFICIENT LIGHTING DEVICES.

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Topic#: 91-183
Office: CSTO
Contract #: DAAH0192CR216
PI: EPHRAIM RUBIN
ID#: 9120383

Title: MULTIMEDIA SCIENCE: COURSEWARE FOR INTERACTIVE LEARNING OF SCIENCE CONCEPTS

Abstract: THE OBJECTIVE OF THIS EFFORT IS TO EXAMINE WAYS IN WHICH A HIGH DEGREE OF EXCITEMENT CAN BE INCORPORATED INTO PHYSICS TEACHING MATERIALS. THE GOAL IS TO DESIGN AN INTERACTIVE MULTIMEDIA, HIGHLY VISUAL PIECE OF COURSEWARE (MODULE) TO TEACH A SINGLE CONCEPT OF PHYSICS. THE MODULE MUST BE DESIGNED TO MAKE USE OF VARIOUS CURRENT DELIVERY TECHNOLOGIES; IT MUST BE FLEXIBLE WITH RESPECT TO TEACHING ENVIRONMENTS, DELIVERY, DISSEMINATION AND DISPLAY SYSTEMS. IT WILL SERVE AS THE PROTOTYPE FOR AN ENTIRE PHYSICS COURSE IN ENGLISH AND SPANISH. FOCUS GROUP SESSIONS WITH HIGH SCHOOL STUDENTS AND TEACHERS WILL ANSWER QUESTIONS SUCH AS THE APPROPRIATE LEVEL OF MATHEMATICS AND THE PREFERRED LENGTH OF EACH LESSON/MODULE. THEY WILL ALSO SUPPLY INFORMATION ON HOW TO MAKE THE PHYSICS MODULE MOST APPEALING TO MINORITY AND FEMALE STUDENTS. A SCRIPT AND STORYBOARDS ANNOTATED TO SHOW INTERACTIVITY AND LEARNING PATHS WILL BE THE MAJOR FINAL WORK PRODUCT ENVISIONED UNDER THIS PROPOSAL. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - A NEW APPROACH TO THE TEACHING OF PHYSICS WHICH TAKES INTO ACCOUNT THE MANY TECHNOLOGIES NOW AVAILABLE FOR DELIVERY. THE MARKET FOR THE FINAL PRODUCT INCLUDES THE US MILITARY AND THE US SCHOOL SYSTEM. SCIENCE MUSEUMS AND HOMES ARE ALSO POTENTIAL MARKETS.

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Topic#: 91-237
Office: ASTO
Contract #: DAAH0192CR129
PI: PING-TONG HO
ID#: 9120002

Title: LOW-COST, MINIATURE TACTICAL JAMMERS

Abstract: A SIMPLE TACTICAL JAMMER IS PROPOSED. THE JAMMER USES A BULK AVALANCHE SWITCH TO GENERATE HIGH-POWER RADIATION IN WELL-UNDER 1 NANOSECOND. THE AVALANCHE SWITCH HAS BEEN DEMONSTRATED TO HANDLE 10'S OF KILOWATTS OF POWER AND REPETITION RATES UP TO 300 KHZ. SCALING UP BOTH THE POWER AND REPETITION RATES ARE POSSIBLE. A LOW-COST, COMPACT, TACTICAL JAMMER WILL BE DEVELOPED WHICH CAN BE DELIVERED BY UNMANNED VEHICLES AND OTHER MILITARY APPLICATIONS.

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Topic#: 91-065
Office:
Contract #: DAAH0191CR197
PI: PING-TONG HO
ID#: 9110708

Title: SINGLE-SHOT, ULTRA WIDEBAND RADIATION DETECTION AND MEASUREMENT USING INTEGRATION-FREE ELECTRO-....

Abstract: AN ELECTRO-OPTIC METHOD WILL BE DEVELOPED FOR DETECTION AND MEASUREMENT OF RANDOM-PULSE, ULTRA WIDEBAND SIGNALS. THE SYSTEM BANDWIDTH IS EXPECTED TO BE UP TO 1,000

GHZ, AND NO CIRCUIT INTEGRATION IS NECESSARY. NO BULKY LASER WILL BE USED. THE PROPOSED WORK WILL INCLUDE A FEASIBILITY STUDY, DETERMINATION OF OPERATING PARAMETERS (MINIMUM DETECTABLE SIGNAL, BANDWIDTH, DYNAMIC RANGE) AND A PROOF-OF-PRINCIPLE EXPERIMENT. THE TOTAL COST WILL BE $49,310 AND THE WORK WILL LAST SIX MONTHS. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - A NEW DETECTION AND MEASUREMENT METHOD FOR RANDOM-PULSE, ULTRA-WIDEBAND SIGNALS WILL BE DEVELOPED. IT WILL FILL A TECHNOLOGY GAP WHICH NOW EXISTS FROM APPROXIMATELY 10 GHZ AND BEYOND. THE MAIN MILITARY BENEFITS WILL BE IN FREE-AIR COMMUNICATIONS IN THE MICROWAVE/MILLIMETER WAVE RANGE.

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Topic#: 91-080 ID#: 9110326
Office:
Contract #: DAAH0192CR032
PI: THOMAS HORSKY
Title: HIGH-DEFINITION MEMBRANE PROJECTION DISPLAY
Abstract: THE OBJECTIVE OF THIS PHASE I PROPOSAL IS THE DEVELOPMENT OF A NEW, LOW-COST, HIGH-RELIABILITY, HIGH-DEFINITION COLOR PROJECTION DISPLAY SYSTEM THAT WILL BE IDEAL FOR APPLICATIONS IN FLIGHT SIMULATORS, C3I AND COCKPITS. THIS THREE-COLOR (RED, GREEN, BLUE) MEMBRANE PROJECTION DISPLAY (MPD) SYSTEM WILL HAVE A 75-MM DIAMETER ACTIVE AREA, 2,000 TELEVISION LINES, 60 HZ FRAMING RATE, AND PROJECTION INTO A 40 DEGREE FIELD OF VIEW WITH 1000 LUMENS AT THE SCREEN. THE MPD SYSTEM MAKES USE OF OPTRON'S PROPRIETARY HIGH-DENSITY MULTI-CONDUCTOR CHARGE TRANSFER PLATE WHICH ENABLES AN ELECTRON-GUN-DEPOSITED CHARGE DISTRIBUTION TO ELECTROSTATICALLY DEFORM A HIGHLY REFLECTIVE METALLIZED MEMBRANE THAT IS STRETCHED OVER WELLS ETCHED INTO THE CHARGE-TRANSFER PLATE. SCHLIEREN FILTERING OF LIGHT REFLECTED FROM THE MEMBRANE YIELDS AN INTENSE, HIGH-CONTRAST-RATIO IMAGE THAT IS PROJECTED WITH AN ACHROMATIC IMAGING SYSTEM ONTO A HIGH-GAIN SCREEN. HIGH BRIGHTNESS AND MULTICOLOR IMAGE REGISTRATION ARE ACHIEVED BY USE OF THE ZERO-ORDER READOUT BEAMS. THE DEVICE OFFERS FLICKERLESS OPERATION BY VIRTUE OF THE FACT THAT OLD FRAMES ARE SIMPLY UPDATED ON A PIXEL BY PIXEL BASIS TO GENERATE THE NEW FRAMES, RATHER THAN BLANKING AND REWRITING ENTIRE FRAMES. THIS DISPLAY ALSO OFFERS THE POSSIBILITY OF MIXING DIFFERENT DISPLAY FORMATS (E.G., GRAPHICS, TEXT) ON THE SAME SCREEN, IN REAL-TIME. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THIS SYSTEM WILL FIND A MULTITUDE OF APPLICATIONS IN THE PRIVATE AND GOVERNMENT SECTORS, INCLUDING HIGH-DEFINITION PROJECTION TELEVISION, C3I DISPLAYS, FLIGHT SIMULATORS, HIGH-DENSITY HIGH-BRIGHTNESS COCKPIT DISPLAYS, AND AIR-TRAFFIC-CONTROL WORKSTATION DISPLAYS.

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Topic#: 91-134 ID#: 9120705
Office: LSO
Contract #: DAAH0192CR207
PI: ROBERT SCHMIDT
Title: MICROACTUATOR ARRAYS FOR ADAPTABLE CONTROL SURFACES
Abstract: FLOW SEPARATION CONTROL IS CRITICAL TO THE PERFORMANCE AND SAFETY OF MILITARY AIRBORNE OR SEABORNE VEHICLES. FLUIDS FLOWING OVER AIRFOILS OR THROUGH FLOW PASSAGES CAN SEPARATE FROM WALL SURFACES, CAUSING FLOW INSTABILITIES. UNCHECKED FLOW SEPARATION CAN RESULT IN VEHICLE POWER LOSS, DAMAGE OR DESTRUCTION. ACTIVE FLOW SEPARATION CONTROL IS REQUIRED BECAUSE VEHICLE PEAK PERFORMANCES USUALLY OCCUR NEAR FLOW SEPARATION CONDITIONS. HISTORICALLY, FLOW SEPARATION CONTROL HAS BEEN ACHIEVED BY MODIFYING CONTROL SURFACE SHAPE/ROUGHNESS OR SURFACE POROSITY USING CONVENTIONALLY-SIZED COMPONENTS. JUST IN THE LAST TWO YEARS, LABORATORIES HAVE DEVELOPED MICROMACHINED DEVICES. ONLY NOW CAN MACRO-SIZED COMPONENTS BE REPLACED BY SUBMILLIMETER-SIZED ACTUATORS, SENSORS AND CONTROLLERS INTEGRATED DIRECTLY INTO CONTROL SURFACES, RESULTING IN HIGHER CONTROL PRECISION, MORE RAPID RESPONSE TIMES AND IMPROVED COMBAT DAMAGE TOLERANCE DUE TO THE

DISTRIBUTED NATURE OF THE MICROACTUATOR SYSTEM. THIS SBIR EXPLORES THE FEASIBILITY OF USING INTERCONNECTED MICROACTUATOR ARRAYS TO PRODUCE ADAPTABLE SURFACES FOR IMPROVED FLOW SEPARATION CONTROL. FOUR MICROACTUATOR CONCEPTS FOR SURFACE ROUGHNESS CONTROL AND THREE CONCEPTS FOR SURFACE POROSITY CONTROL HAVE BEEN DEFINED. COMPARISONS OF DISCRETE MICRODEVICE SPECIFICATIONS AND MICROFABRICATION REQUIREMENTS FOR SUCCESSFUL LARGE SCALE INTEGRATION INTO SUBSONIC AND SUPERSONIC AIRFOILS WILL BE MADE WITH OPTIMIZED MICRODEVICE ARRAYS SELECTED FOR A PHASE II PROOF-OF-PRINCIPLE DEMONSTRATOR. PROJECT RESULTS WILL BE APPLICABLE TO DEVELOPING MICROMECHANICALLY-CONTROLLED ADAPTABLE SURFACES (I.E., AIRFOILS, RUDDERS, FLAPS, PROPELLERS) AND FLUID-HANDLING COMPONENTS (I.E., DIFFUSERS, MIXERS, EXPANDERS) FOR FLOW SEPARATION CONTROL AND BOUNDARY LAYER CONTROL SYSTEMS IN MILITARY AIRBORNE AND SEABORNE VEHICLES, MISSILES, COMMERCIAL AIRCRAFT, TURBINES, PUMPS AND COMPRESSORS.

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Topic#: 91-068 ID#: 9110467
Office:
Contract #: DAAH0191CR304
PI: THOMAS BROTHERTON
Title: APPLICATIONS OF DATA FUSION TO SIGNAL PROCESSING
Abstract: A PROBLEM OF INTEREST TO THE U.S. NAVY IS THE DEVELOPMENT OF SIGNAL PROCESSING TECHNIQUES TO DETECT AND CLASSIFY THREAT SOURCES OF SHORT-DURATION, ACOUSTIC TRANSIENT EVENTS IN UNDERWATER ACOUSTIC DATA. THE PROBLEM IS VERY DIFFICULT BECAUSE (1) EVERY THREAT SOURCE HAS MANY CLASSES OF ASSOCIATED ACOUSTIC EVENTS, AND (2) THE UNDERWATER ENVIRONMENT HAS AN EVEN GREATER NUMBER OF INTERFERENCE ACOUSTIC EVENTS, SUCH AS THOSE FROM BIOLOGICS. ORINCON HAS FOUND THROUGH EXPERIEMENTS WITH ACTUAL TRANSIENT DATA THAT NO SINGLE SIGNAL PROCESSING TECHNIQUE CAN CREATE SUFFICIENT FEATURES TO ENABLE ONE TO DISTINGUISH UNIQUELY AMONG THE LARGE CLASSES OF TRANSIENTS. RATHER, SEVERAL TECHNIQUES ARE REQUIRED TO GENERATE METRICS FROM WHICH TRANSIENTS CAN BE CLASSIFIED. THE DATA FUSION OF THESE FEATURES IS DIFFICULT BECAUSE (1) EACH FEATURE-VERSUS-TIME PLOT FOUND FROM PROCESSING REAL DATA IS USUALLY A COMPLEX PATTERN TO THE HUMAN EYE, AND (2) THE AGGREGATE PATTERN FROM ALL THE FEATURES IS EVEN MORE COMPLEX TO PERCEIVE. THIS PROPOSAL WILL DETERMINE THE FEASIBILITY OF USING A REAL-TIME MASSIVE NEURAL NETWORK WITH OVER 10,000 INPUT NODES (BEYOND CURRENT REAL-TIME NEURAL NETWORK HARDWARE TECHNOLOGY) TO PERFORM FUSING OF MULTIPLE FEATURE-VERSUS-TIME GRAMS. IN PHASE II, THE ALGORITHMIC APPROACHES DETERMINED FEASIBLE WILL BE IMPLEMENTED BY EXPLOITING NEW NEURAL NETWORK HARDWARE TECHNOLOGY UNDER DEVELOPMENT BY DARPA. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - MASSIVE NEURAL NETWORK DATA FUSION OF MULTIPLE COMPLEX FEATURE EXTRACTION ALGORITHM OUTPUTS WILL SHORTEN THE CYCLE TIME TO FIELD AN OPERATIONAL TRANSIENT PROCESSING SYSTEM FOR NAVY APPLICATIONS. THE MULTIFEATURE APPROACH WILL INCREASE THE PROBABILITY OF DETECTION AND CORRECT CLASSIFICATION, DECREASE THE PROBABILITY OF FALSE ALARM AND MISCLASSIFICATION, AND BROADEN THE NUMBER OF CLASSES THAT CAN BE CLASSIFIED.

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Topic#: 91-106 ID#: 9121131
Office: DSO
Contract #:
PI: S. LAWRENCE MARPLE, JR.
Title: APPLICATIONS OF GABOR BASES TO EXTRACTING INFORMATION FROM THE WIGNER-VILLE TRANSFORM
Abstract: THE PROPOSED RESEARCH APPLIES NOVEL TRANSDUCTION PRINCIPLES USED IN THE MAMMALIAN AUDITORY SYSTEM TO TRANSFORM THE INPUT SIGNALS PRESENTED TO ARTIFICIAL NEURAL NETWORKS PERFORMING SONAR SIGNAL CLASSIFICATION TASKS. THESE NOVEL BIOACOUSTIC TRANSFORMS WILL BE INTERFACED WITH ORINCON'S ARTIFICIAL NEURAL NETWORK (ANN) CLASSIFIER, AND THEIR IMPACT ON

CLASSIFICATION PERFORMANCE WILL BE MEASURED AND COMPARED TO CLASSIFIER PERFORMANCE WHEN THE DISCRETE FOURIER TRANSFORM (DFT) IS USED. THE BIOACOUSTIC TRANSFORMS TO BE IMPLEMENTED, TESTED, AND COMPARED TO THE DFT ARE THE LYON-MEAD TRANSFORM AND THE GHITZA TRANSFORM. THEY ARE BASED UPON THE PROCESSING DONE IN THE MAMMALIAN COCHLEA AND IN THE MAMMALIAN AUDITORY NERVE, AND DIFFER SIGNIFICANTLY IN FREQUENCY RESPONSE, GAIN CONTROL, AND NONLINEAR EFFECTS FROM THE DFT SIGNAL TRANSFORM. THE NOVEL BIOACOUSTIC SIGNAL-TRANSFORMATION TECHNIQUES IMPLEMENTED AND TESTED HERE MAY LEAD TO MORE ROBUST AUTOMATIC CLASSIFICATION SYSTEMS, PARTICULARLY WHEN THERE ARE FEW TRAINING PATTERNS, MANY INTERFERING SIGNALS, AND NOISY BACKGROUNDS. THESE RESULTS HAVE APPLICABILITY TO THE DEVELOPMENT OF HIGH-SPEED, LOW-POWER, ULTRACOMPACT SOLUTIONS TO ACOUSTIC CLASSIFICATION PROBLEMS IN THE AREAS OF UNMANNED UNDERSEA VEHICLES, SUBMARINE SONARS, UNDERSEA SURVEILLANCE SYSTEMS, IMPROVED TORPEDOES, TORPEDO DEFENSE, AND MINE DEFENSE.

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Topic#: 91-109 ID#: 9120274
Office: DSO
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PI: TERENCE THOMPSON

Title: BIOLOGICAL SIGNAL PROCESSING: BIOLOGICAL SIGNAL TRANSFORMS FOR NEURAL NETWORKS PERFORMING SONAR SIGNAL CLASSIFICATION...

Abstract: TIME-FREQUENCY REPRESENTATIONS OF ACOUSTIC TRANSIENT EVENTS ARE OFTEN REQUIRED IN ORDER TO DISTINGUISH SUBTLE LOCALIZED TIME AND FREQUENCY FEATURES IN THE TRANSIENT SIGNAL THAT CAN BE MISSED BY CLASSICAL SHORT-TIME FOURIER TRANSFORM ANALYSIS. TWO TIME-FREQUENCY REPRESENTATIONS APPROPRIATE FOR THIS SIGNAL CLASS ARE THE WIGNER-VILLE TRANSFORM AND THE GABOR REPRESENTATION. THE WIGNER TENDS TO HAVE SOMEWHAT HIGHER RESOLUTION CAPABILITY THAN GABOR, BUT ITS QUADRATIC FUNCTION OF THE SIGNAL LEADS TO CROSS-TERMS IN THE TRANSFORM THAT ARE DIFFICULT TO CLASSIFY IN THE PRESENCE OF NOISE. THE GABOR HAS SOMEWHAT LESS RESOLUTION, BUT ITS LINEAR FUNCTION OF THE SIGNAL LEADS TO MORE UNDERSTANDABLE EFFECTS IN THE PRESENCE OF NOISE. THIS PROPOSAL SUGGESTS TWO APPROACHES TO UTILIZE THE GABOR BASIS FUNCTIONS FROM THE GABOR REPRESENTATION THAT CAN BE USED TO ENHANCE THE PERFORMANCE OF THE WIGNER TRANSFORM IN THE PRESENCE OF NOISE. THE PRIMARY BENEFIT WILL BE AN IMPROVED WIGNER TECHNIQUE FOR ANALYZING ACOUSTIC TRANSIENT SIGNALS IN NOISE FOR A KEY DOD PROGRAM TO EXPLOIT THESE TRANSIENTS AS A MEANS TO FIND QUIET SUBMARINES.

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Topic#: 91-182 ID#: 9120723
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Contract #: DAAH0192CR124
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Title: INTEGRATED TECHNOLOGY COMPUTER AIDED DESIGN

Abstract: TECHNOLOGY COMPUTER AIDED DESIGN (TCAD) IS THE APPLICATION OF COMPUTER TOOLS TO EXPEDITE THE DESIGN OF INTEGRATED CIRCUIT MANUFACTURING PROCESSES. MANY OF THE TOOLS WHICH ARE USED WERE EITHER DEVELOPED INDEPENDENTLY IN UNIVERSITIES OR IC MANUFACTURING COMPANY RESEARCH CENTERS. CONSEQUENTLY, COMPLEX TCAD TOOLS ARE DIFFICULT TO DEVELOP AND MAINTAIN. TCAD RESEARCHERS HAVE IDENTIFIED THE NEED FOR TCAD FRAMEWORKS. TAKING A LEAD FROM THE ELECTRONICS COMPUTER AIDED DESIGN (ECAD) INDUSTRY, TCAD RESEARCHERS HAVE ESTABLISHED A WORKING GROUP WITHIN THE CAD FRAMEWORK INITIATIVE (CFI) TO EXPLORE THE DEVELOPMENT OF STANDARDS FOR TCAD FRAMEWORKS. THIS WORK WILL IDENTIFY THE NEEDS OF THE TCAD COMMUNITY FOR A FRAMEWORK AND DETERMINE THE FEASIBILITY OF THE EXISTING CDB/PREDITOR TOOLS AS A BASIS FOR THE FRAMEWORK. THE FRAMEWORK WILL BE COMPATIBLE WITH THE CFI STANDARDS. THE UNIQUE FEATURE OF THIS FRAMEWORK WILL BE ITS ADDITIONS TO SUPPORT MANUFACTURING ANALYSIS AND LINKS TO ECAD. THE TCAD DEVELOPERS HAVE IGNORED THESE ENGINEERS. THIS CDB/PREDITOR BASED FRAMEWORK HAS POTENTIAL COMMERCIAL APPLICATIONS FOR

BOTH PREEXISTING AND FUTURE TCAD TOOLS. INTERFACES TO PREEXISTING TOOLS OFFER THE TCAD COMMUNITY A CONSISTENT GRAPHICAL INTERFACE AND DATABASE AMONG ALL TCAD TOOLS. THE FRAMEWORK ALSO EXPEDITES THE DEVELOPMENT OF NEW TOOLS BY SUPPLYING THE GRAPHICAL INTERFACE, INTER-TOOL COMMUNICATIONS, AND DATABASE ROUTINES. THE ABILITY TO HANDLE STATISTICAL DATA ALLOWS THE FRAMEWORK TO ADDRESS THE NEED FOR TCAD INFORMATION IN MANUFACTURING ANALYSIS AND CIRCUIT DESIGN. THIS PHASE I PROJECT WILL RESULT IN A SOFTWARE SPECIFICATION FOR A TCAD FRAMEWORK. CONCEPT VERIFICATION WILL ALSO BE PERFORMED THROUGH IMPLEMENTATION OF THE SPECIFICATION USING CDB/PREDITOR.

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Topic#: 91-198 ID#: 9120799
Office: CSTO
Contract #: DAAH0192CR146
PI: JOHN KIBARIAN

Title: INTEROPERABLE TECHNOLOGY COMPUTER-AIDED DESIGN (CAD) TOOLS FOR ELECTRONIC CAD

Abstract: PDF SOLUTIONS PROPOSES TO DEVELOP A STATISTICAL DESIGN TOOL FOR PROCESS/DEVICE AND CIRCUIT DESIGN IMPROVEMENT. BOTH PROCESS AND CIRCUIT DESIGNERS HAVE DIFFICULTY QUANTIFYING THE EFFECT OF PROCESS VARIABILITY UPON A CIRCUIT'S PARAMETRIC YIELD. EXISTING METHODS RELY ON EMPIRICAL OR QUALITATIVE METHODS THAT EITHER PRECLUDE CONCURRENT ENGINEERING OR ARE NOT BASED UPON THE PROCESS PHYSICS. EXISTING TCAD TOOLS WERE DEVELOPED FOR PROCESS AND DEVICE DESIGN BUT DO NOT ALLOW FOR STUDY OF CIRCUIT PERFORMANCE VARIANCE. THE PROPOSED TOOL WILL AUTOMATE THE TRANSFER OF INFORMATION BETWEEN PROCESS DEVELOPERS AND CIRCUIT DESIGNERS. BASED ON PDF'S SIMULATION ENGINE, THE TOOL WILL MODEL BOTH DEVICE AND CIRCUIT VARIABILITY BASED ON INHERENT FLUCTUATIONS IN PROCESS CONTROLS AND ENVIRONMENTAL VARIABLES. PROCESS AND CIRCUIT DESIGN ENGINEERS WILL HAVE THE ABILITY TO DESIGN NEW PROCESSES AND CIRCUITS THAT ARE LESS SENSITIVE TO MANUFACTURING VARIABILITY. A PROTOTYPE VERSION OF THE TOOL WILL CALCULATE STATISTICALLY ACCURATE WORST CASE DEVICE MODELS FOR CIRCUIT SIMULATION. PRESENT METHODS OF WORST CASE DEVICE DESIGN ARE AD HOC AND DO NOT ALLOW THE CONCURRENT APPLICATION OF DESIGN FOR MANUFACTURABILITY TO THE PROCESS AND CIRCUIT. PDF SOLUTIONS IS A TCAD SOFTWARE DEVELOPER WHOSE CHARTER IS TO PROVIDE SOFTWARE APPLYING PROCESS SIMULATION TO DESIGN FOR MANUFACTURABILITY AND MANUFACTURE ANALYSIS. AS SUCH, IT IS IN A UNIQUE POSITION TO DELIVER THE PROPOSED TOOL. THIS PHASE I PROJECT WILL RESULT IN A SPECIFICATION FOR THE STATISTICAL DESIGN TOOL AND THE ADDITIONAL FEATURE REQUIRED OF A TCAD FRAMEWORK TO SUPPORT THE ANALYSIS. A PROTOTYPE VERSION OF THE TOOL WHICH CALCULATES WORST CASE DEVICE MODELS WILL ALSO BE DEVELOPED FOR CONCEPT VERIFICATION.

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Topic#: 91-006 ID#: 9110292
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PI: ROBERT YOUNGQUIST

Title: THE EXTENSION OF A LIGHT INFANTRY FOOT SOLDIER'S HEARING INTO THE ULTRASONIC

Abstract: THE ABILITY OF THE INFANTRY FOOT SOLDIER TO DETECT ENEMY FOOT SOLDIERS WOULD BE HEIGHTENED BY THE EXTENSION OF HIS HEARING INTO THE ULTRASONIC REGION OF THE ACOUSTIC SPECTRUM. RECENT RESULTS INDICATE THAT ACTIVITIES SUCH AS WALKING OR CRAWLING THROUGH GRASS OR SAND, OR RUBBING CLOTHING OR SKIN TOGETHER EMIT SIGNIFICANT ULTRASONIC SIGNATURES IN THE 40 KHZ REGION OF THE ACOUSTIC SPECTRUM WHILE GIVING OFF MINIMAL AUDIO SIGNALS. A SMALL, RUGGED, ULTRASONIC DETECTION SYSTEM WHICH ACTED AS A NATURAL EXTENSION OF A SOLDIER'S HEARING WOULD ENHANCE HIS ABILITY TO DETECT ENEMY SOLDIERS. IT IS PROPOSED THAT THE ABOVE CONCEPT BE DEMONSTRATED BY DESIGNING AND FABRICATING A TEST BED SYSTEM WHICH WILL DETECT ULTRASONICS, MIX THE DETECTED SIGNAL DOWN TO THE AUDIO FREQUENCIES, AND DRIVE A SET OF SPEAKERS TO ALLOW A PERSON TO HEAR NATURALLY IN THE ULTRASONICS. THE PRIMARY

TECHNICAL TASK OF THE DEVELOPMENT IS DESIGN OF A TRANSDUCER SYSTEM, INCLUDING FOCUSING ELEMENTS AND A ELECTRONIC SUMMING NETWORK, WHICH WILL MIMIC THE DIRECTIONALITY AND RELATIVE SENSITIVITY OF THE HUMAN EARS SO THAT THE SOLDIER CAN LOCATE AN ULTRASONIC SOURCE AS IF HE WERE HEARING IT IN THE AUDIO ACOUSTIC RANGE. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS- ULTRASONIC LEAK DETECTORS ALREADY EXIST ON THE MARKET BUT ARE BULKY HAND-HELD UNITS. THE INCORPORATION OF THIS TECHNOLOGY INTO HEADGEAR WITH NATURAL DIRECTIONALITY WOULD PROVIDE AN INEXPENSIVE AND MINIATURE HEARING EXTENSION SYSTEM WHICH COULD OPERATE WITH LITTLE OR NO TRAINING. IT SHOULD PROVE USEFUL IN USING PERSONNEL TO LOCATE HIDDEN FUGITIVES, ANIMALS IN BRUSH AND FIELDS, LEAKS, VARIOUS MECHANICAL PROBLEMS, AND ANY OTHER SOURCE OF ULTRASONICS. IT WOULD NOT REPLACE THE EXISTING LEAK DETECTORS BUT WOULD SUPPLEMENT THEM.

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Topic#: 91-030 ID#: 9110480
Office:
Contract #: DAAH0191CR232
PI: LOUIS CHU

Title: IN-SITU SENSING & CONTROLLING OF HIGH TEMPERATURE MANUFACTURING PROCESSES...

Abstract: METAL-ORGANIC CHEMICAL VAPOR DEPOSITION (MOCVD) IS ONE OF THE LEADING TECHNOLOGIES FOR HGCDTE WAFER PRODUCTION, THE MATERIAL OF CHOICE FOR IR FOCAL PLANE ARRAY FABRICATION. CURRENTLY, THERE ARE NO CLOSED FORM MATHEMATICAL MODELS FOR HGCDTE WAFER GROWTH USING MOCVD. MOCVD GROWTH OF HGCDTE INVOLVES NON-LINEAR RELATIONSHIPS BETWEEN REACTOR CONTROL PARAMETERS AND MATERIAL GROWTH OUTPUT PARAMETERS (VIA OPTICAL SENSORS). THIS IS PARTLY DUE TO THE FACT THAT CHANGES IN MERCURY GAS FLOW RATES HAVE NON-LINEAR EFFECTS ON REACTION RATES. IT WOULD BE BENEFICIAL IF A CONTROLLER COULD LEARN THE NON-LINEAR RELATIONSHIP BETWEEN CONTROL PARAMETERS AND OUTPUT SENSORS FROM THE GROWTH PROCESS. NEURAL NETWORK LEARNING MODELS OFFER THE TECHNOLOGY FOR THE DEVELOPMENT OF CONTROLLERS BY INTERACTIVELY OBSERVING THE BEHAVIOR OF THE GROWTH PROCESS AND BUILDING AN INTERNAL MODEL OF MOCVD WAFER FABRICATION. THIS PROPOSAL ADDRESSES THE DEVELOPMENT OF A NEURAL NETWORK ARCHITECTURE FOR IN-SITU CONTROL OF THE METAL-ORGANIC CHEMICAL VAPOR DEPOSITION (MOCVD) PROCESS FOR WAFER GROWTH. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE RESULT OF FINER CONTROL OF WAFER GROWTH IS THE FABRICATION OF HIGHER QUALITY WAFERS. CURRENTLY, MOCVD IS ONE OF THE LEADING TECHNOLOGIES FOR HGCDTE WAFER PRODUCTION. THE HGCDTE MATERIAL IS OF GREAT IMPORTANCE IN THE DEVELOPMENT OF FOCAL PLANE ARRAYS, WHICH ARE CRITICAL COMPONENTS OF FLIRS FOR GROUND, AIRBORNE, AND COMBAT WEAPON SYSTEMS. THE FABRICATION OF HIGHER QUALITY HGCDTE DETECTORS WILL RESULT IN THE DEVELOPMENT OF MORE SOPHISTICATED FOCAL PLANE ARRAYS AND, IN TURN, THE CONSTRUCTION OF FLIR-BASED WEAPONS CAPABLE OFFER GREATER STANDOFF RANGES.

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Topic#: 91-177 ID#: 9120388
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Contract #: DAAH0192CR201
PI: YEE-YEEN CHU

Title: INFRARED FOCAL DESIGN WITH ON-FOCAL PLANE SIGNAL PROCESSING, FOR MULTIPLE SYSTEM APPLICATIONS

Abstract: INFRARED FOCAL PLANE ARRAY (IRFPA) AND ELECTRO-OPTICAL (EO) SYSTEMS ARE CRITICAL COMPONENTS NEEDED FOR MANY TACTICAL SYSTEM APPLICATIONS. THE DEVELOPMENT OF MOST ON-FOCAL PLANE PROCESSING IS STILL IN THE ADVANCED DEVELOPMENT STAGE AND REQUIRES ADDITIONAL ENGINEERING TO YIELD PRODUCIBLE IRFPA/EO SYSTEMS. CONCURRENT DESIGN (CD) METHODS AND TOOLS HOLD GREAT POTENTIAL FOR IMPROVED PRODUCIBILITY, REDUCED CYCLE TIME, AND COST. MUCH OF THE CD METHODS HAVE NOT BEEN APPLIED TO IRFPA/EO DEVELOPMENT PROCESS DUE TO THE ABSENCE OF THE INTER-PROCESS MODEL AND SIMULATION. THE OBJECTIVE OF THE PHASE

I PROGRAM IS TO IDENTIFY AND DESIGN A SET OF ANALYTICAL AND KNOWLEDGE-BASED MODELS AND SIMULATIONS THAT IS KEY TO THE CD OF A GENERIC FAMILY OF IRFPA/EO SYSTEMS. THE IRFPA/EO DEVELOPER WILL HAVE THE CAPABILITY TO DETERMINE (A) THE PRODUCIBILITY OBSTACLES IMPOSED BY MATERIAL AND MANUFACTURING PROCESSES AND (B) THE WAYS TO ADJUST SYSTEM DESIGN AND PRODUCTION TO BE CONSISTENT WITH CRITICAL IRFPA/EO TECHNOLOGY DEVELOPMENT.

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Topic#: 91-144 ID#: 9121094
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Contract #: DAAH0192CR115
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Title: A NOVEL FRACTAL-SENSITIVE IMAGE PROCESSOR FOR DETECTING GROUND TARGETS WITH SUPPRESSED SIGNATURES

Abstract: WE PROPOSE TO DEMONSTRATE THE FEASIBILITY OF CONSTRUCTING AN ON-LINE IMAGE PROCESSOR WHICH WILL LOCATE ALL MANMADE COMPONENTS (TANKS, AIRCRAFT, ALL CURRENT CAMOUFLAGE, ETC.) IN A SCENE. THIS NOT ONLY GREATLY NARROWS THE REGIONS FOR SEARCH BUT ALSO MAKES THE RECOGNITION TASK MUCH EASIER, SINCE IT NO LONGER REQUIRES DISCRIMINATION AGAINST NATURAL BACKGROUND. THE SYSTEM IS BASED ON THE FRACTAL (STATISTICALLY SELF SIMILARITY AT ALL MAGNIFICATIONS) PROPERTIES OF NATURAL SCENES AND THE ABSENCE OF THAT PROPERTY IN MANMADE OBJECTS. SEVERAL COHERENT OPTICAL SPACE INVARIANT MONITORS OF FRACTAL DIMENSIONALITY WILL BE DEVELOPED AND TESTED. A DETAILED ENGINEERING DESIGN OF A COMPACT, ROBUST AND POWER EFFICIENT FRACTAL-SENSITIVE IMAGE PROCESSOR (FIP) WILL BE PRESENTED BASED ON THE EXPERIENCE OF DEMONSTRATING SUCH A SYSTEM. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE PROPOSED FRACTAL-SENSITIVE IMAGE PROCESSOR IS APPLICABLE NOT ONLY TO DOD, BUT ALSO TO DEA, EPA AND OTHER GOVERNMENT ORGANIZATIONS THAT DEAL WITH CONCEALMENT. FOR THE DOD, THE ABILITY TO SEGREGATE NATURAL AND MANMADE COMPONENTS OF A SCENE IS OF VALUE IN EVERYTHING FROM RECONNAISSANCE TO TRACKING. POTENTIAL COMMERCIAL APPLICATIONS INCLUDE MEDICAL MONITORING, PROCESS CONTROL, ETC.

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Topic#: 91-192 ID#: 9120427
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Contract #: DAAH0192CR178
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Title: HIGHLY PARALLEL REAL-TIME FIBER OPTICAL MULTI-WAVELENGTH NETWORK FOR LONGER DISTANCE PERSONAL MULTI-MEDIA CONFERENCING

Abstract: FOR IMPLEMENTING MULTI-MEDIA CONFERENING AND COLLABORATION SERVICES BETWEEN WORKSTATIONS, PHYSICAL OPTICS CORPORATION (POC) PROPOSES A HIGHLY PARALLEL REAL-TIME FIBER OPTICAL MUTLI-WAVELENGTH NETWORK BASED ON MULTI-MODE (62.5/125) FIBER OPTICS, MUTLI-LONGITUDINAL MODE (MLM) LDS, AVALANCHE PHOTODIODE (APD) RECEIVERS, AND POC'S COMMERCIALLY AVAILABLE WAVELENGTH DIVISION MULTIPLEXERS (WDMS). IN ADDITION TO PROVIDING THE STANDARD FEATURES ASSOCIATED WITH FIBER OPTIC LINKS (HIGH BANDWIDTH, LOWER WEIGHT, IMMUNITY FROM EMI AND EMP INTERFERENCE), POC'S MULTI-WAVELENGTH NETWORKS HAVE IMPORTANT ADVANTAGES OVER OTHER CURRENT STATE-OF-THE-ART NETWORKS: AN EXCELLENT POWER BUDGET MARGIN ALLOWS FOR THE USE OF A SIZABLE VARIETY OF PASSIVE COMPONENTS SUCH AS WDMS, STAR COUPLERS, EO SWITCHES AND MODULATORS, AND NARROW-BAND SPECTRAL FILTERS. THE SYSTEM POSSESSES HIGH TRANSPARENCY (AT LEAST -25 DB OPTICAL CROSSTALK OR -50 DB ELECTRIC CROSSTALK). IT IS POSSIBLE TO PROVIDE MULTI-MEDIA (VIDEO, VOICE, COMPUTER DATA, SENSOR DATA) HIGH SPEED (100 MHZ/S OR 100 MB/S) TRANSMISSION WITHIN A SINGLE FIBER. THIS CAN EITHER GREATLY REDUCE THE REQUIRED NUMBER OF CABLES OR SIGNIFICANTLY INCREASE SYSTEM REDUNDANCY AND CAPACITY. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - POC'S FIBER OPTIC NETWORK SYSTEM IS REAL-TIME, WIDE BANDWIDTH, HIGHLY PARALLEL, MULTI-CHANNEL, LOWER COST, IMMUNE TO EMI AND EMP, PROVIDES MORE REDUNDANT CHANNELS FOR EXTENDING COMMUNICATION CAPABILITIES, AND

CAN BE READILY COMBINED WITH OTHER KINDS OF NETWORKS FOR COMMERCIAL APPLICATIONS.

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Contract #: DAAH0192CR126
PI: MICHAEL BURROWS

Title: 193 NM EXCIMER LASER DEVELOPMENT FOR LITHOGRAPHY

Abstract: THE LASER PARAMETERS MOST IMPORTANT TO LITHOGRAPHY APPLICATIONS ARE BEAM QUALITY AND LASER WAVELENGTH. A SIGNIFICANT UP-GRADE OF ARF LASER PERFORMANCE IN THESE KEY AREAS CAN BE ACHIEVED IN AN ALTERNATIVE SYSTEM. AN UNSTABLE RESONATOR CAVITY IN WHICH THE EXCITATION LIFETIME IS ON THE ORDER OF 35 NSEC WILL BE USED AS AN OSCILLATOR. THIS IS MUCH LONGER EXCITATION TIME THAN IN DISCHARGE PUMPED ARF, THEREBY PROVIDING AMPLE TIME FOR THE BUILD-UP OF A HIGH BEAM QUALITY UNSTABLE RESONATOR CAVITY MODE. TEMPORALLY SELECTIVE AMPLIFICATION OF THE LATER PORTION OF THE OSCILLATOR OUTPUT WILL THEN TAKE PLACE IN A SEPARATE AMPLIFIER. THE NET CONVERSION EFFICIENCY OF ARF LASER PHOTONS TO VUV LASER PHOTONS IS PREDICTED TO BE 25%. TUNABLE EXCITATION WILL PERMIT LASING AT WAVELENGTHS OF 151.7, 162, 166, 172, OR 185 NM. USING COMMERCIALLY AVAILABLE LASERS, THE PREDICTED NO LASER OUTPUT AT 162 - 185 NM IS > 55 MJ/PULSE OR > 10 WATTS. SUCCESSFUL DEMONSTRATION OF LASING AT THESE WAVELENGTHS IN PHASE I WILL ULTIMATELY PERMIT THE EXTENSION OF THIS TECHNIQUE TO CO LASING AT 115 NM IN A FOLLOW-ON EFFORT. THIS CORRESPONDS TO A LASER PHOTON ENERGY IN EXCESS OF 10 EV, WHICH IS COMPARABLE TO THE CUT-OFF FREQUENCY OF SYNCHROTRON RADIATION. THE PROPOSED ARF PUMPED SYSTEM WILL PROVIDE AN EFFICIENT, TUNABLE VUV UP-GRADE OF EXISTING ARF LITHOGRAPHY SYSTEMS. THE UP-GRADE WILL SIGNIFICANTLY ENHANCE THE PERFORMANCE OF THESE CURRENT SYSTEMS, PROVIDING A LOW COST, SIMPLE TO OPERATE ALTERNATIVE TO SYNCHROTRON RADIATION SOURCES.

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PI: DARIUSH MODARRESS

Title: ADVANCED A/D MONOLITHIC CHIP ARCHITECTURE DESIGNS FOR WIDE DYNAMIC RANGE AND GIGASAMPLE CONVERSION RATES

Abstract: MONOLITHIC IMPLEMENTATION OF DATA CONVERTERS AT THE 8 BIT, 1 GIGA SAMPLES PER SECOND LEVEL ARE CONSIDERED A HIGH PRIORITY ITEM FOR MANY MILITARY AND COMMERCIAL APPLICATIONS, RANGING FROM THE MMIC/VHSIC INTERFACE TO RADAR SIGNAL PROCESSING, ELECTRONIC COUNTERMEASURES, AND INSTRUMENTATION. THESE HIGH SAMPLING RATES MANDATE THE USE OF VERY HIGH SPEED ARCHITECTURES OBTAINED VIA EXPENSIVE PROCESSING TECHNOLOGIES SUCH AS HETEROJUNCTION BIPOLAR TRANSISTORS (HBTS). ANALOG TO DIGITAL (A/D) CONVERTERS THAT ARE KNOWN TO WORK AT THE HIGHEST SPEED TYPICALLY INVOLVE A STRAIGHT FLASH ARCHITECTURE, PRECEDED BY A DIODE-BRIDGE SAMPLE AND HOLD (S/H) CIRCUIT. HOWEVER, IT IS DIFFICULT TO ATTAIN SINGLE-CHIP IMPLEMENTATIONS FOR CONVERTERS WITH RESOLUTION GREATER THAN 8 BITS BECAUSE THESE TOPOLOGIES INVOLVE A LARGE DEVICE COUNT AND LARGE POWER DISSIPATION. FURTHERMORE, MULTI-CHIP REALIZATIONS YIELD DEGRADED PERFORMANCE AND INCREASED POWER DISSIPATION COMPARED TO MONOLITHIC APPROACHES, DUE TO OVERHEAD INCURRED WHEN DRIVING SIGNALS BETWEEN CHIPS. THE PURPOSE OF THIS RESEARCH IS TO INVESTIGATE MORE EFFICIENT ARCHITECTURES IN TERMS OF CHIP SIZE, POWER CONSUMPTION, AND 8-BIT RESOLUTION AT 1 GIGASAMPLES PER SECOND USING NEW ADVANCED PROCESS TECHNOLOGIES SUCH AS HBTS. THE RESULTS OF THE INNOVATION PROPOSED HEREIN CAN BE USED FOR MANY MILITARY AND COMMERCIAL APPLICATIONS RANGING FROM THE MMIC/VHSIC INTERFACE TO RADAR SIGNAL PROCESSING, ELECTRONIC COUNTER MEASURES, AND INSTRUMENTATION.

PHYSICAL SCIENCES, INC.
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Phone: (405) 355-1471
Topic#: 91-057
Office:
Contract #: DAAH0191CR162
PI: JIM FERGUSON
ID#: 9110003
Title: PROBE PARTICLES FOR IN-SITU DIRECT MEASUREMENT OF VORTICITY VECTORS
Abstract: SCIENTISTS AT PHYSICAL SCIENCES, INC. HAVE DEVELOPED AN OPTICAL TECHNIQUE, KNOWN AS THE VORTICITY OPTICAL PROBE, OR VOP, FOR DIRECTLY MEASURING VORTICITY VECTORS IN WATER FLOWS. THE VORTICITY OPTICAL PROBE OPERATES BY SEEDING INTO LIQUID FLOW TRANSPARENT SPHERICAL PARTICLES THAT ARE TENS OF MICRONS IN DIAMETER WITH EACH CONTAINING ONE OR MORE EMBEDDED LEAD CARBONATE CRYSTALS THAT ACT AS PLANAR REFLECTORS OR "MIRRORS." RECENTLY, A TECHNIQUE HAS BEEN DEVELOPED FOR MANUFACTURING THESE PROBE PARTICLES FROM ACRYLAMIDE GELS, FOR THE FIRST TIME ENABLING THEIR USE IN WATER FLOWS. HOWEVER, THE CURRENT GEL PARTICLE PRODUCTION TECHNIQUE PERMITS SIMPLE MANUFACTURE OF ONLY SMALL QUANTITIES. TO SEED A FLOW THAT WOULD BE OF INTEREST TO DARPA, A DEVICE FOR MASS PRODUCING THE PROBE PARTICLES IS NEEDED. DEVELOPMENT OF THIS DEVICE IS PROPOSED HEREIN. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THIS ADVANCED DEVELOPMENT EFFORT WILL ESTABLISH THE FEASIBILITY OF APPLYING THE VOP TO STUDIES OF CRITICAL FLOWFIELDS IN WATER TUNNELS OR AROUND TEST VEHICLES. IT WILL LAY THE FOUNDATION FOR A PHASE II EFFORT WHEREIN A COMPLETE VOP INSTRUMENT WILL BE USED TO ACQUIRE DATA IN A FLOWFIELD OF INTEREST TO DARPA. SUCCESS IN PHASE II WILL DEMONSTRATE TO THE FLUID DYNAMICS COMMUNITY THAT THE VOP IS AN INVALUABLE NEW MEASUREMENT TECHNIQUE, THEREBY ESTABLISHING A BASIS FOR COMMERCIAL SALES OF INSTRUMENTS AND PROBE PARTICLES TO OTHER LABORATORIES WORLDWIDE.

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Phone: (301) 459-3031
Topic#: 91-112
Office: MTO
Contract #: DAAH0192CR189
PI: C. CHRISTENSEN
ID#: 9120364
Title: COMPACT, QUASI-CW ARF LASERS FOR PHOTOLITHOGRAPHY
Abstract: A SMALL HIGH-REPETITION-RATE ARF LASER UTILIZING MICROWAVE DISCHARGE EXCITATION WILL BE CONSTRUCTED FOR INTERFEROMETRY AND MASTER OSCILLATOR APPLICATIONS IN PHOTOLITHOGRAPHY. THE LASER WILL EXHIBIT A SPECTRAL WIDTH OF APPROXIMATELY 2 PICOMETERS AND IS EXPECTED TO OPERATE IN A LOW-ORDER TRANSVERSE MODE. IT SHOULD BE CAPABLE OF PULSE REPETITION RATES IN EXCESS OF ONE KILOHERTZ. THE PROPOSED LOW-ORDER TRANSVERSE MODE WOULD FIND APPLICATIONS IN INJECTION CONTROL OF LARGER ARF LASERS AND IN UV RAMAN SPECTROSCOPY. IN ADDITION, MANY APPLICATIONS EXIST IN MICROFABRICATION AND CHEMICAL ANALYSIS FOR A FAR ULTRAVIOLET SOURCE WHICH IS COMPACT, WITH REDUCED MAINTENANCE REQUIREMENTS.

PROMETHEUS, INC.
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Phone: (401) 849-5389
Topic#: 91-045
Office:
Contract #: DAAH0191CR260
PI: PAUL ABRAHAMS
ID#: 9110031
Title: SOFTWARE REVERSE ENGINEERING TOOLS FOR INCLUSION IN OPEN ARCHITECTURE ENVIRONMENTS
Abstract: REVERSE ENGINEERING DERIVES THE SPECIFICATION OF A SOFTWARE SYSTEM FROM ITS IMPLEMENTATION. IT REQUIRES BOTH A SPECIFICATION LANGUAGE AND A SET OF TOOLS. AS OUR SPECIFICATION LANGUAGE WE USE SEDL; AS OUR INPUT LANGUAGE WE USE C; AND AS OUR PROTOTYPE WORKING ENVIRONMENT WE USE ARCADIA. SEDL, A SOFTWARE ENGINEERING DESIGN LANGUAGE DEVELOPED AT IBM, IS AN EXTENSION TO ADA THAT PROVIDES HIGH-LEVEL DICTIONS FOR EXPRESSING BEHAVIOR AND DATA SPECIFICATIONS AND THEIR REFINEMENTS; SET, LIST, AND MAP TYPES; A VARIETY OF USEFUL CONSTRUCTS AND OPERATIONS ON THESE TYPES; AND SUPPORT FOR ABSTRACT DATA TYPES. SEDL SUPPORTS THE ENTIRE REVERSE ENGINEERING CYCLE, INCLUDING THE TRANSFORMATION OF THE

SPECIFICATION INTO ADA. OUR OBJECTIVES ARE TO SPECIFY AN ABSTRACT SYNTAX FOR C THAT SUPPORTS MANIPULATION OF C PROGRAMS; TO DEVELOP A CATALOG OF AD HOC TRANSFORMATIONS OF C CODE; TO SPECIFY THE STRUCTURAL AND FLOW INFORMATION NEEDED TO SUPPORT THESE TRANSFORMATIONS; AND TO DESIGN A SPECIALIZED SMART INTERACTIVE EDITOR THAT CAN APPLY TRANSFORMATIONS IN RESPONSE TO SIMPLE COMMANDS. WE USE SEDL BECAUSE IT SUPPORTS BEHAVIOR SPECIFICATIONS AND THEIR REFINEMENTS, ABSTRACT DATA TYPES, AND OPERATIONS ON SETS, LISTS, AND MAPS. WE SUPPORT TRANSFORMATIONS THAT REORGANIZE THE CONTROL FLOW, REPLACE SPECIALIZED C CONSTRUCTS SUCH AS POINTER ARITHMETIC, TRANSLATE C DATA TYPES TO SEDL DATA TYPES, TRANSFORM IMPERATIVE CONTROL STRUCTURES TO SPECIFICATIONS OF THEIR RESULTS, AND FIND NATURAL BOUNDARIES OF COMPONENTS OF THE SYSTEM.THE WORK ON C WILL GENERALIZE TO OTHER LANGUAGES. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE "OLD CODE" PROBLEM IS PERVASIVE IN BOTH THE MILITARY AND COMMERCIAL WORLDS. IN THIS PROJECT WE SHALL DEVELOP THE TOOLS AND TECHNIQUES FOR DEALING WITH OLD CODE THROUGH REVERSE ENGINEERING.

PROTOTYPE SIMULATIONS
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Phone: (213) 376-8426
Topic#: 91-141 ID#: 9120117
Office: LSO
Contract #: DAAH0192CR182
PI: RONALD JANZ
Title: COMBINED ARMS BATTLE LOGISTICS SIMULATION
Abstract: EVEN THOUGH THE NEED TO MAINTAIN COMBAT READINESS REMAINS HIGH, THE NUMBER AND SCOPE OF OPERATIONAL TRAINING MANEUVERS, LIVE-FIRE EXERCISES, AND LOW-LEVEL FLIGHT TRAINING CONTINUES TO DECREASE BECAUSE OF SAFETY, SECURITY AND ENVIRONMENTAL CONCERNS, AS WELL AS BUDGETARY LIMITATIONS. BECAUSE OF THESE CONSTRAINTS, A DISTRIBUTED SIMULATION OF A COMBINED ARMS BATTLE WAS PREVIOUSLY DEVELOPED TO PROVIDE TRAINING IN BATTLEFIELD TACTICS. HOWEVER, THE SIMULATION LACKS A REALISTIC TREATMENT OF LOGISTICS OPERATIONS. THE SIGNIFICANCE OF THIS DEFICIENCY WAS RECENTLY DEMONSTRATED BY THE MAJOR CONTRIBUTION THAT WELL-EXECUTED LOGISTICS MADE TO THE SUCCESS OF OPERATIONS DESERT SHIELD AND DESERT STORM. THE LONG TERM GOAL OF THIS PROJECT IS TO DEVELOP A REALISTIC LOGISTICS SIMULATION THAT CAN BE READILY INTEGRATED INTO THE EXISTING SIMULATION NETWORK. THE PHASE I GOAL OF THIS PROJECT IS TO DEVELOP REQUIREMENTS AND A CONCEPTUAL DESIGN FOR THIS SIMULATION. THE REQUIREMENTS WILL BE DEVELOPED IN A TOP-DOWN STRUCTURED MANNER. THE CONCEPTUAL DESIGN WILL INCORPORATE A KNOWLEDGE-BASED APPROACH. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - SUCCESSFUL COMPLETION OF PHASE I OF THIS PROJECT IS A PREREQUISITE FOR THE DETAILED DESIGN AND IMPLEMENTATION OF THE LOGISTICS COMPONENT OF AN EXISTING TACTICAL TRAINING SIMULATION. THE APPLICATION OF KNOWLEDGE-BASED TECHNIQUES WILL CONTRIBUTE TO A DEPARTMENT OF DEFENSE GOAL THAT HAS BEEN RECENTLY SET FOR BATTLE MANAGEMENT SIMULATIONS.

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Phone: (213) 204-5050
Topic#: 91-074 ID#: 9110268
Office:
Contract #: DAAH0191CR280
PI: GEORGE TAYLOR
Title: FUEL CELL CATALYST FOR DIRECT OXIDATION OF METHANOL
Abstract: BASED ON RECENTLY GENERATED NEW EXPERIMENTAL KNOWLEDGE CONCERNING THE ELECTROCHEMICAL OXIDATION OF METHANOL, WE PROPOSE TO PREPARE INNOVATIVE HIGH SURFACE AREA CARBON SUPPORTED ALLOY ELECTROCATALYSTS WITH CONTROLLED CRYSTALLOGRAPHIC SURFACES. THESE PREPARED MATERIALS WILL BE CHARACTERIZED WITH RESPECT TO PARTICLE SIZE, SHAPE, CRYSTAL STRUCTURE, AND SURFACE COMPOSITION USING TEM, XRD, AND EXAFS. ELECTROCHEMICAL EVALUATION WILL BE DONE WITH CYCLIC VOLTAMMETRY, ROTATING DISC ELECTRODE, AND IN-SITU EXAFS TECHNIQUES. ANALYSIS OF THIS DATA WILL YIELD INFORMATION REGARDING THE KINETICS AND MECHANISM OF METHANOL OXIDATION AS WELL AS PROJECTED

PERFORMANCE OF A DIRECT METHANOL FUEL CELL. THE EXPECTED IMPROVEMENT OF THESE INNOVATIVE CATALYSTS IS 500 TO 600 MV IN ANODE PERFORMANCE AND WOULD LEAD TO A VIABLE DIRECT METHANOL FUEL CELL. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE SUCCESSFUL DEVELOPMENT OF AN ELECTROCATALYST WITH HIGH ACTIVITY AND STABILITY FOR METHANOL OXIDATION WOULD LEAD TO DIRECT METHANOL-AIR FUEL CELL POWER SOURCES. THE MAJOR ADVANTAGES OF THESE FUEL CELLS ARE 1) OPERATION ON NON-PETROLEUM DOMESTIC FUELS, AND 2) "CLEAN" AND EFFICIENT OPERATION. AN IMPORTANT COMMERCIAL APPLICATION OF THE DIRECT METHANOL-AIR FUEL CELL IS IN THE AREA OF ELECTRIC POWERED VEHICLES. IMPORTANT MILITARY APPLICATIONS INCLUDE SUBMARINES, SPACE PLATFORMS, AND UNMANNED UNDERWATER VEHICLES.

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Topic#: 91-113 ID#: 9120501
Office: MTO
Contract #: DAAH0192CR220
PI: FARLA FLEMING

Title: EARLY WARNING FAILURE DETECTION USING NEURAL NETWORKS

Abstract: MACHINERY HEALTH MONITORING IS CRITICAL IN SYSTEMS WHERE REDUNDANCY CAPABILITY IS LIMITED AS IN A HELICOPTER GEARBOX. IN ORDER TO DECIDE ON THE MOST EFFICIENT, SAFE, AND COST-EFFECTIVE PROGNOSIS, THE DEGREE OF SEVERITY OF A FAULT MUST BE DETERMINED. AT PRESENT, CONDITION ASSESSMENT TECHNIQUES ARE BEING EXPLORED WHICH REQUIRE A LARGE AMOUNT OF PROCESSING AND PRODUCE A LIMITED CATEGORIZATION OF THE DEGREE OF SEVERITY. THEY ARE ALSO LIMITED BY LOW SIGNAL TO NOISE LEVELS AT THE EARLY FAULT STAGE. A DIAGNOSTIC SYSTEM FOR SUCH CONDITION ASSESSMENT IS PROPOSED USING A NEURAL NETWORK TO IMPROVE ON THE SPEED AND PRECISION OF DIAGNOSIS. PSI TECHNOLOGY COMPANY PROPOSES TO DEVELOP A TECHNIQUE FOR REAL-TIME, CONTINUOUS HEALTH MONITORING OF ROTATING MACHINERY USING NEURAL NETWORKS TO PROCESS RAW TIME TRACES. IN PHASE I, EXISTING IN-HOUSE, WELL-CHARACTERIZED BEARING DATA FROM A CONTROLLED EXPERIMENT ON BEARINGS TESTED UNTIL DESTRUCTION, WILL BE USED TO TRAIN AND TEST A NETWORK WHICH WILL PROVIDE A DECISION ON WHETHER A CERTAIN LEVEL OF THE SEVERITY OF A FAULT HAS BEEN REACHED. THE HIGH SPEED PERFORMANCE OF SUCH A NETWORK WILL BE CHARACTERIZED FOR ACCURACY AND RANGE OF FAULT DIAGNOSIS. HARDWARE REQUIREMENTS FOR A NEURAL NETWORK IMPLEMENTATION WILL ALSO BE DETERMINED. IN PHASE II, CONSTRUCTION AND SITE TESTING OF A PROTOTYPE, AS WELL AS AN EXPANDED REPERTOIRE OF COMPONENT DIAGNOSTICS WILL BE CARRIED OUT. THE ABILITY TO DETECT FAULTS AND TO ASSESS THE SEVERITY OF SUCH FAULTS IN ROTATING MACHINERY IN REAL-TIME MAY BE USED TO MONITOR THE ASSEMBLY LINE QUALITY OF MACHINERY. IT MAY BE USED ON ANY TURBINE OR PUMP SYSTEM WHOSE HEALTH IS TIME CRITICAL. THE ELECTRIC UTILITIES COULD USE SUCH A SYSTEM TO MONITOR TURBINES AND GENERATORS AND MINIMIZE DOWN TIME AND REPLACEMENT COSTS. ADDITIONAL USES INCLUDE MONITORING THE HEALTH OF COMPLEX AUTOMATED MANUFACTURING EQUIPMENT TO REDUCE THE RISK OF ASSEMBLY DOWN TIME OR POOR QUALITY COMPONENTS.

Q-DOT, INC.
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Phone: (719) 590-1112

Topic#: 91-114 ID#: 9121194
Office: MTO
Contract #: DAAH0192CR128
PI: DONALD HERMAN, JR.

Title: ADVANCED ANALOG-TO-DIGITAL CONVERTER DESIGN STUDIES FOR WIDE DYNAMIC RANGE, GIGASAMPLE CONVERSION RATE, MONOLITHIC...

Abstract: Q-DOT PROPOSES A VERY HIGH-SPEED (10 - 20 GS/S) MEDIUM-RESOLUTION (6-BIT) ANALOG-TO-DIGITAL CONVERTER (ADC) USING AN ADVANCED HETEROJUNCTION BIPOLAR TRANSISTOR (HBT) PROCESS. INNOVATIVE CIRCUIT DESIGN, COMBINED WITH A VERY FAST HBT PROCESS, WILL BE USED TO DESIGN A PRACTICAL WIDE BANDWIDTH CONVERTER. THE DESIGN WILL ACCOUNT FOR THE REDUCED COMPLEXITY REQUIRED BY AN EMERGING TECHNOLOGY BY USING ANALOG ENCODING AT THE INPUT AND GRAY LOGIC DECODING. THIS DESIGN WILL REDUCE THE NUMBER OF INPUT COMPARATORS BY A FACTOR

OF TWO TO FOUR, WITH SUBSEQUENT REDUCTION OF THE LOGIC CIRCUIT COMPLEXITY. ANALOG ENCODING MINIMIZES THE LOADING EFFECT OF THE ADC ON THE DRIVING CIRCUITRY AND EASES THE INPUT MATCHING REQUIREMENTS. THE GRAY LOGIC DECODE WILL REDUCE THE BIT ERROR RATE AT HIGH SAMPLE RATES. THE COMBINATION WILL YIELD A VERY FAST (10 - 20 GS/S) MONOLITHIC ADC WITH MODERATE (6-BIT) RESOLUTION. A VERY HIGH-SPEED ADC WILL FIND NUMEROUS APPLICATIONS IN COMMERCIAL AND MILITARY TELECOMMUNICATION SYSTEMS. COMMERCIAL SATELLITE LINKS, INSTRUMENTATION AND HIGH-SPEED DATA TRANSMISSION SYSTEMS WILL ALL BENEFIT. MILITARY RADAR AND EW SYSTEMS CAN BE ENHANCED AND DOWN CONVERTERS SIMPLIFIED BY USING THE WIDE BANDWIDTH OF THIS CONVERTER.

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Topic#: 91-094 ID#: 9120510
Office: DSO
Contract #: DAAH0192CR211
PI: DARYOUSH ALLAEI

Title: APPLICATION OF LOCALIZED VIBRATION AND SMART MATERIALS IN CONTROLLING THE DYNAMIC RESPONSE OF STRUCTURES

Abstract: IN THE TREATMENT OF THE DYNAMIC PROBLEMS OF STRUCTURES, TWO ALTERNATE TESTING METHODS, BASED ON EXTERNAL AND EMBEDDED SENSORS, EXIST IN THE LITERATURE. IF THE SENSORS RESPOND TO THE CHANGES IN THE DYNAMIC CHARACTERISTICS OF THE STRUCTURE, AND/OR THE ENVIRONMENT, THEN THEY ARE REFERRED TO "SMART" STRUCTURES. SMART SENSORS AND SMART MATERIALS HAVE BEEN USED FOR DETECTING STRUCTURAL DAMAGES AND/OR CONTROLLING THE VIBRATION CHARACTERISTICS OF THE STRUCTURES. RECENT DEVELOPMENTS IN NEW MATERIALS, AND IN VIBRATION PHENOMENONS SUCH AS MODE LOCALIZATION AND TRANSITION HAVE MADE THE RESEARCHERS TO LOOK FOR WAYS OF COMBINING THE TWO IN ORDER TO MORE EFFECTIVELY ALTERING STRUCTURAL RESPONSE TO DYNAMIC LOADS. THE OBJECTIVE OF THIS PROPOSED RESEARCH IS TO INVESTIGATE THE FEASIBILITY OF DEVELOPING A MORE EFFICIENT AND PRECISE SMART STRUCTURES BASED ON SMART MATERIALS, SUCH AS SHAPE MEMORY ALLOYS, AND/OR EMBEDDING SENSORS, SUCH AS OPTICAL FIBERS, AND VIBRATIONAL PHENOMENONS SUCH AS LOCI CROSSING AND VEERING, AND MODE LOCALIZATION AND TRANSITION. IN PARTICULAR, SUCH PHENOMENONS WILL BE ENFORCED ON THE STRUCTURES SO THAT THE UNDESIRED VIBRATIONS ARE CONFINED TO A SMALLER REGION, AND THEREFORE EASIER TO DETECT AND CONTROL. SHAPE MEMORY MATERIALS AND OPTICAL FIBERS WILL BE USED TO DETECT AND CONTROL THE PARAMETERS THAT ARE MORE CRUCIAL IN VIBRATION RESPONSE OF THE STRUCTURE. SUCH COMBINATION WILL RESULT IN A HUGE REDUCTION IN THE NUMBER OF THE SENSORS, SIGNIFICANT GAIN IN COMPUTATIONAL SPEED, AND IMPROVING THE ACCURACY OF THE CONTROL SYSTEM. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE OUTCOME OF THIS SBIR PROJECT WILL RESULT IN SIGNIFICANT ADVANCEMENT IN THE FIELD OF SMART STRUCTURES. IT WILL ENHANCE THE CAPABILITIES OF THE SYSTEMS USED BY DOD, NASA, AEROSPACE AND OTHER COMMERCIAL INDUSTRIES. THE COMMERCIAL APPLICATIONS OF SUCH DEVELOPMENT INCLUDE DAMAGE CONTROL, CONFINEMENT OF STRUCTURAL VIBRATIONS, AND VIBRATION CONTROL WHICH SIGNIFICANTLY IMPROVE THE PERFORMANCE AND RELIABILITY OF STRUCTURES.

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Topic#: 91-076 ID#: 9110416
Office:
Contract #: DAAH0191CR185
PI: LAWRENCE RUBIN

Title: APPLICATION OF HTSC INTERCONNECTS FOR HIGH SPEED DIGITAL ELECTRONIC CIRCUITRY

Abstract: THE IMPROVEMENTS OF THE INTRINSIC DEVICE SPEEDS IN DIGITAL INTEGRATED CIRCUIT TECHNOLOGIES MADE POSSIBLE BY THE REDUCTIONS IN DEVICE DIMENSIONS (I.E., IMPROVED LITHOGRAPHY) AND OTHER ADVANCES OF IC TECHNOLOGY (INCLUDING THE USE OF GAAS OR RELATED COMPOUND SEMICONDUCTORS RATHER THAN SILICON) ARE BECOMING INCREASINGLY DIFFICULT TO TRANSLATE INTO CORRESPONDING SYSTEM PERFORMANCE IMPROVEMENTS BECAUSE OF PACKAGING

INTERCONNECT LIMITATIONS. WHILE INTER-CHIP SIGNAL INTERCONNECT PROPAGATION DELAYS CAN BE GREATLY REDUCED BY HYBRID WAFER SCALE PACKAGING IN WHICH VLSI CHIPS VIRTUALLY TILE AND INTERCONNECT-BEARING SUBSTRATE IN A HIGH DENSITY MULTI-CHIP MODULE (MCM) IMPLEMENTATION OF THE ELECTRONIC CIRCUITRY, THE RESISTIVITY OF NORMAL METAL INTERCONNECTS MAKES SUCH MCMS EXTREMELY DIFFICULT TO REALIZE IN REASONABLY LARGE SIZES (E.G., CARRYING MANY HUNDREDS OF HIGH I/O COUNT CHIPS). BY USING HIGH TEMPERATURE SUPERCONDUCTORS (HTSCS) FOR THE SIGNAL INTERCONNECTS IN THE MCM SUBSTRATE, CONDUCTOR LINEWIDTHS OF THE ORDER OF 2UM WOULD BE USEABLE, ALLOWING THE WIRING OF VERY COMPLEX MCMS WITH ONLY A FEW SIGNAL INTERCONNECT PLANES THAT COULD REQUIRE 50 OR MORE NORMAL METAL SIGNAL INTERCONNECT LAYERS. THE GOAL OF THE PROPOSED STUDY IS TO, BASED ON THE ASSUMPTION OF THE DEVELOPMENT OF A PRACTICAL HTSC MCM TECHNOLOGY, A) IDENTIFY TYPES OF SYSTEM APPLICATIONS WHICH COULD MOST BENEFIT FROM HTSC MCM PACKAGING, B) CONSIDER A SPECIFIC EXAMPLE OF AN ELECTRONICS PACKAGE AND EVALUATE THE COST-BENEFIT OF UPGRADING WITH HTSC MCM TECHNOLOGY, AND C) IDENTIFY THE CAE TOOL MODIFICATIONS NECESSARY TO MAKE THE APPLICATION OF THE HTSC MCM TECHNOLOGY TO REAL SYSTEMS PRACTICAL. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE DEVELOPMENT OF A PRACTICAL 80 DEGREES K HTSC MCM TECHNOLOGY, SUPPORTED BY THE PROPER CAE TOOLS, WILL MAKE POSSIBLE LARGE, HIGH DENSITY (E.G., 6 MILLION EQUIVALENT GATES ON A 6" SUBSTRATE) MCMS.

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Topic#: 91-080 ID#: 9110384
Office:
Contract #: DAAH0191CR169
PI: GEORGE STOPTI

Title: HIGH PERFORMANCE SPATIAL LIGHT MODULATORS EMPLOYING ELECTRON TRAPPING MATERIALS

Abstract: WE PROPOSED HEREIN AN INTEGRATED SPATIAL LIGHT MODULATOR (SLM) EMPLOYING QUANTEX ELECTRON TRAPPING (ET) MATERIALS. THE PROPOSED SPATIAL LIGHT MODULATOR OFFERS UNIQUE ADVANTAGES OVER OTHER SLM DEVICES, SUCH AS: CAPABILITY OF CONVERTING INCOHERENT TO COHERENT LIGHT; CAPABILITY OF FUNCTIONING AS A PHOTODETECTOR; HIGH SPEED COST EFFECTIVENESS; AND HIGH RESOLUTION. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - IF THIS RESEARCH IS SUCCESSFUL THE COST-EFFECTIVE BUT HIGH PERFORMANCE ET MATERIAL BASED SLM WITH THE CAPABILITY OF DETECTION AND INCOHERENT TO COHERENT LIGHT CONVERSION CAN MEET OPTICAL PROCESSING REQUIREMENTS. SOME FUNCTIONS INTRODUCED BY SUCH AN SLM ARE MEMORY, FRAME INTERACTION AND ANALOG OPERATION. IT IS PREDICTED THAT THE COMMERCIAL BREAKTHROUGH FOR SLMS WILL COME WHEN 1000 X 1000 PIXELS ARRAY CAN RUN AT 1KHZ FRAME RATE.

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Topic#: 91-168 ID#: 9120838
Office: MTO
Contract #: DAAH0192CR151
PI: ABDELHAK BENSAOULA

Title: RHEED ANALYSIS AND CONTROL OF MBE GROWTH OF OPTOELECTRONIC MATERIALS

Abstract: CONVENTIONAL MOLECULAR BEAM EPITAXY (MBE) GROWTH CONTROL SYSTEMS ARE EITHER OPERATED MANUALLY OR WITH SIMPLE LINEAR CONTROLLERS USING PREDEFINED RECIPES. WE WILL SUPPLEMENT A STANDARD CONTROL SYSTEM WITH A NEURAL NETWORK BASED CONTROLLER. THE NEURAL NETWORK WILL BE TAUGHT BY GROWING GAAS/ALGAAS SUPERLATTICES USING THE CONVENTIONAL TECHNIQUES. SUBSEQUENTLY, THE NEURAL NETWORK WILL BE ALLOWED TO TAKE FULL CONTROL OF THE GROWTH PROCESS. EVALUATION OF THE PERFORMANCE OF THE NEURAL NETWORK WILL BE BASED ON A COMPARISON OF SUPERLATTICES GROWN BY CONVENTIONAL AND NEURAL TECHNIQUES. A NEURAL NETWORK BASED MBE GROWTH CONTROL SYSTEM WILL GREATLY ENHANCE THE QUALITY AND REPEATABILITY OF III-V FILM CHARACTERISTICS. THIS WILL LOWER DEVICE COSTS AND IMPROVE DEVICE PERFORMANCE.

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Phone: (505) 883-1994
Topic#: 91-096 ID#: 9120833
Office: DSO
Contract #: DAAH0192CR041
PI: GEORGE RHODES
Title: NON DESTRUCTIVE EVALUATION OF CERAMIC BEARINGS
Abstract: RESONANT ULTRASOUND INSPECTION CAN RAPIDLY FIND CRACKS FLAWS AND TOLERANCE ERRORS IN SOLID STRUCTURES. IN METALLIC BEARINGS, WE HAVE MEASURED SPHERICITY TO 50PPM (.0002 MM IN .5 CM BEARING) AND, IN ADDITION, WERE ABLE TO DETERMINE THE PRESENCE OF FLAWS WITH THE SAME SENSITIVITY. RECENT TESTS BY LANL, USING A JOINT LANL/QUATRO PATENT DISCLOSURE, HAVE INCREASED THIS SENSITIVITY SEVERAL FOLD, HOWEVER, THESE RESULTS HAVE NOT BEEN QUANTIFIED. THIS CONCEPT UTILIZES THE DETECTION OF HARMONIC COMPARISONS IN BOTH THE DRY AND SOLVENT WETTED CONDITIONS. QUATRO WILL APPLY THIS TECHNIQUE TO CERAMIC BEARINGS BY SUBJECTING THE SUBSTRATE TO A BROAD SPECTRUM ACOUSTIC SIGNAL AND EXAMINING THE RESULTANT HARMONIC RESONANCES. OUR INSTRUMENTATION WILL THEN SUBTRACT THE SPECTRA TO DETERMINE THE PRESENCE OF FLAWS. THE OBJECTIVE OF THIS PROPOSAL IS TO DEVELOP A PROCESS, INCLUDING THE SOFTWARE, HARDWARE AND PROCEDURES BY WHICH A CERAMIC BEARING MAY HAVE ITS SPECTRUM TAKEN WITHIN 1 SECOND. THIS WILL THEN BE DEVELOPED INTO AN ACCEPTANCE TEST TO SELECT QUALIFIED BEARINGS. TO DETERMINE MANUFACTURING TOLERANCE LIMITS AND NON DESTRUCTIVE DETECTION OF STRESS OR CORROSION INDUCED CRACKS AND FLAWS. THIS TECHNIQUE SHOULD BE LESS EXPENSIVE, FASTER, PORTABLE AND MORE VERSATILE THAN PULSE ECHO, FLUORESCENT DYE PENETRANT, MAGNETIC PARTICLE AND EDDY CURRENT TECHNIQUES. RESONANT ULTRASOUND INSPECTION DETECTS FLAWS ON INACCESSIBLE INTERNAL SURFACES.

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Topic#: 91-127 ID#: 9120712
Office: LSO
Contract #: DAAH0192CR165
PI: ALAN MUELLER
Title: MICROFRACTURING-BASED CONTINUUM DAMAGE MODELS FOR HYDROCODE APPLICATIONS
Abstract: THE MATERIAL MODELS PRESENTLY USED IN HYDROCODES, ESPECIALLY THOSE DESCRIBING FAILURE AND FRACTURE, ARE ARGUABLY THE WEAKEST LINK AND THE LEAST DEVELOPED PART OF THOSE CODES; YET THEY ARE ESSENTIAL IN STUDIES WHERE THE FINAL RESULTING STATE OF AN IMPACT EVENT IS THE PRIMARY FOCUS OF THE CALCULATION. PARTICULARLY FOR BRITTLE MATERIALS, SUCH AS CERAMICS, THE EXISTING TOOLS SORELY NEED TO INCLUDE CONCEPTS OF FRACTURE MECHANICS THAT INCORPORATE MODELS OF CRACK AND FLAW DISTRIBUTIONS, THE GROWTH OF THOSE CRACKS AS A TIME-DEPENDENT PHENOMENON, AND THE ULTIMATE JOINING OR COALESCENCE OF THOSE CRACKS LEADING TO ULTIMATE FRACTURE. IN ADDITION, THE DEVELOPMENT OF DAMAGE MODELS HAS BEEN IMPEDED BY THE SPARSITY OF DATA THAT CLEARLY DEMONSTRATES HOW THE MICROSTRUCTURAL PROCESSES INTERACT TO YIELD THE APPARENT BULK BEHAVIOR OF THE MATERIAL UNDER IMPACT LOADING. THE OBJECTIVES OF THE PROPOSED EFFORT WILL BE TO DEVELOP A CONTINUUM DAMAGE MODEL BASED ON CONCEPTS OF MICROFRACTURE MECHANICS AND TO INCORPORATE AND TEST THE MODEL IN THE WELL-KNOWN CTH HYDROCODE; AND TO DEMONSTRATE THAT DIRECT MICROMECHANICAL FINITE ELEMENT ANALYSIS, SIMULATING THE DETAILED INTERACTION ON THE MICROSCOPIC LEVEL, IS A USEFUL TOOL TO GUIDE THE DEVELOPMENT OF THE CONTINUUM DAMAGE MODEL WHERE DIRECT OBSERVATIONS ARE NOT POSSIBLE. THE PROPOSED APPROACH WILL IMPROVE THE ABILITY OF HYDROCODES TO PREDICT THE OUTCOME OF HIGH-VELOCITY IMPACTS INVOLVING BRITTLE, MULTIPHASE MATERIALS SUCH AS CERAMICS. IN ADDITION, THE DIRECT NUMERICAL MICROMECHANICAL SIMULATIONS WILL PROVIDE AN IMPORTANT TOOL TO EVALUATE RATIONALLY AND QUANTITATIVELY NEW DAMAGE MODEL CONCEPTS AS THEY EVOLVE. THE MODELS DEVELOPED UNDER THIS EFFORT COULD POTENTIALLY BE APPLIED IN COMMERCIAL FINITE ELEMENT CODES FOR THE RELIABILITY ANALYSIS OF COMPOSITES. THE DIRECT NUMERICAL MICROMECHANICAL ANALYSIS COULD BE AN IMPORTANT TOOL FOR UNDERSTANDING THE BASIC MECHANISMS OF FRACTURE TOUGHENING.

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Topic#: 91-138 ID#: 9121057
Office: ASTO
Contract #: DAAH0192CR160
PI: WILLIAM MOFFAT
Title: ACOUSTIC CHARGE TRANSPORT DIGITALLY PROGRAMMABLE TRANSVERSAL FILTER ENHANCEMENT OF ESM/ATD NCTR SENSITIVITY AND SEL....
Abstract: THE OPERATIONAL PROBLEM ADDRESSED IS LONG RANGE PASSIVE "HOSTILE" TARGET RECOGNITION FOR OWN FIRE CONTROL RADAR SET-ON. THE SPECIFIC PROJECT OBJECTIVE IS TO DEMONSTRATE DIGITAL SET-ON OF AN ELECTRONIC DECISIONS, INC (EDI) ACOUSTIC CHARGE TRANSPORT (ACT) DIGITALLY PROGRAMMABLE TRANSVERSAL FILTER (DPTF), BY A PREVIOUS RADCON DEVELOPED, CLASSIFIED ESM/ECM RECEIVER, FOR ENHANCED SENSITIVITY AND SELECTIVITY OF ANOTHER RADCON DEVELOPED, CLASSIFIED ESM RECEIVER, WHICH EXTRACTS UNIQUE TARGET PLATFORM IDENTIFIERS . THESE RADCON PROCESSORS HAVE BEEN DEVELOPED UNDER PREVIOUS SBIR PHASE II CONTRACTS. THE PROCESSES APPLY GENERIC TRANSFORM AND CORRELATION MATHEMATICS. SIGNIFICANT EXPLOITATION HAS BEEN MADE OF EMERGING ANALOG TECHNOLOGY FOR INFORMATION EXTRACTION AND EMERGING DIGITAL SPEED FOR REAL TIME LOGIC CONTROL. THIS PROGRAM APPLIES THE DEVELOPING ANALOG DPTF AS A NEAR REAL TIME ADAPTIVE PRESELECT FILTER, COVERING THE 100MHZ INTERMEDIATE FREQUENCY (I.F.) REGION, BANDWIDTH 150MHZ. THE ESM/ECM RECEIVER, WHICH PROVIDES DPTF SET-ON, INCLUDES A DYNAMIC SORT/TRACK/PREDICTOR OF PRIORITY EMITTER'S NEXT CARRIER FREQUENCY AND PULSE TIME OF ARRIVAL. NECESSARY HARDWARE WILL BE OBTAINED AS GFP. ALL TESTS WILL BE CONDUCTED IN THE RADCON MICROWAVE LABORATORY. ANTICIPATED RESULTS ARE INCREASED SENSITIVITY BY THE ORDER OF 20DB AND INCREASED SELECTIVITY IN EXCESS OF 50DB. ANTICIPATED BENEFITS ARE INCREASED TRACK RANGE, THROUGH ANTENNA BACKLOBES, OF LOW PEAK POWER EMITTERS; REDUCED INTERFERENCE IN COMPLEX ENVIRONMENTS, FOR PASSIVE NON COOPERATIVE TARGET RECOGNITION (PNCTR) ENHANCEMENT OF DOD GUIDED MISSILE INTERCEPT SYSTEMS. PROCESSES ARE GENERIC WITH POTENTIAL COMMERCIAL COMMUNICATION SYSTEM APPLICATION.

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Topic#: 91-002 ID#: 9110663
Office:
Contract #: DAAH0191CR199
PI: HARRY MAY
Title: ACT CHANNELIZER TUNER
Abstract: THE DEVELOPMENT OF A NEW VHF/UHF CHANNELIZER TUNER ARCHITECTURE USING ACOUSTIC CHARGE TRANSPORT (ACT) TECHNOLOGY IS PROPOSED. THE TUNER TRANSLATES A 15 MHZ SPECTRAL BANDWIDTH IN THE VHF/UHF RANGE INTO A DIGITIZED OUTPUT FOR DIGITAL SIGNAL PROCESSING. THE PROPOSED TUNER ARCHITECTURE IS UNIQUE COMPARED WITH CONVENTIONAL TUNER ARCHITECTURES, AND OFFERS THE POTENTIAL OF A VERY SMALL SIZE TUNER, PERHAPS AS A SINGLE HYBRID OR MONOLITHIC DEVICE. ALONG WITH SMALL SIZE, THE TUNER WILL ALSO BE VERY LIGHTWEIGHT, LOW COST, AND HAVE A LOW POWER CONSUMPTION. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE VERY SMALL SIZE, LIGHTWEIGHT, LOW COST, AND LOW POWER CONSUMPTION OF THIS TUNER ARCHITECTURE WILL ALLOW SYSTEM CONCEPTS REQUIRING MULTIPLE TUNER CHANNELS ACROSS MULTIPLE ANTENNA ARRAY ELEMENTS FOR DIRECTION FINDING AND INTERFERENCE CANCELLATION, AS WELL AS MULTIPLE TUNER CHANNELS ACROSS AN ENTIRE FREQUENCY SPECTRUM TO PROVIDE VERY WIDEBAND SIGNAL INTERCEPT TO BE ECONOMICALLY PRACTICAL.

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Topic#: 91-135 ID#: 9120201
Office: ASTO
Contract #: DAAH0192CR197
PI: JEFFREY BRUSH
Title: NONLINEAR DYNAMICS FOR ACOUSTIC NOISE REMOVAL

Abstract: THIS PHASE I SBIR PROPOSAL EXPLOITS RTA'S RECENT DEVELOPMENT OF NONLINEAR DYNAMICS (NLD)-BASED PROCESSING METHODOLOGIES TO THE PROBLEM OF AUTOMATIC AND ADAPTIVE NOISE CANCELLATION. RTA WILL ANALYZE PROPRIETARY TECHNIQUES AND ADVANCES IN THE OPEN LITERATURE, TO IDENTIFY AREAS OF PERFORMANCE. ADDITIONALLY, RTA WILL EXTEND THE THEORETICAL CONNECTION BETWEEN TRADITIONAL NOISE CANCELLATION PROCESSING AND THE NEW, NONLINEAR TECHNIQUES. RTA WILL ADAPT CURRENTLY OPERATIONAL, PROPRIETARY NLD-BASED SIGNAL PROCESSING SOFTWARE MODULES TO PROVIDE A DEMONSTRATION OF THESE CONCEPTS FOR THIS EFFORT. IN A PLANNED PHASE II FOLLOW-ON EFFORT, THE NLD-BASED TECHNIQUES IDENTIFIED IN THIS PHASE I EFFORT WILL BE REFINED AND IMPLEMENTED ON RTA'S MICROVAX SYSTEMS. NLD-AUGMENTED NOISE REDUCTION AND CANCELLATION HAS WIDE APPLICATION TO A LARGE NUMBER OF U.S. GOVERNMENT COMMUNICATIONS PROGRAMS AND TO THOSE MORE GENERALLY CONCERNED WITH SIGNAL PROCESSING, FILTERING, AND OTHER SIGNAL/NOISE PROBLEMS. ACOUSTIC SYSTEMS IN PARTICULAR WILL BENEFIT. USES FOR NLD-BASED SIGNAL PROCESSING ABOUND IN THE ENGINEERING AND AUTOMOTIVE FIELDS

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Topic#: 91-212 ID#: 9120167
Office: SSTO
Contract #: DAAH0192CR040
PI: RUBEN PRIETO-DIAZ

Title: DARE: A DOMAIN ANALYSIS AND REUSE ENVIRONMENT

Abstract: DOMAIN ANALYSIS (DA) HOLDS THE KEY FOR A SYSTEMATIC, FORMAL, AND EFFECTIVE PRACTICE OF SOFTWARE REUSE. PROPOSED APPROACHES AND METHODS FOR DA ASSUME THAT DOMAIN KNOWLEDGE EXISTS AND IS READILY USABLE. EXPERIENCE INDICATES, HOWEVER, THAT ACQUIRING AND STRUCTURING KNOWLEDGE IS THE BOTTLENECK OF DA. A RECENT METHODOLOGY DEVELOPED BY REUSE, INC. FOR THE STARS PROGRAM (REUSE LIBRARY PROCESS MODEL, RLPM) EMPHASIZES THE EARLY ANALYSIS ASPECTS OF KNOWLEDGE ACQUISITION AND KNOWLEDGE STRUCTURING. THE RLPM CONVERTS THE AD-HOC NATURE OF DA INTO A REPEATABLE PROCEDURE WITH WELL DEFINED, TANGIBLE OUTPUTS. THIS IS A PROPOSAL TO ASSESS THE POTENTIAL FOR AUTOMATION OF DA. EXISTING TECHNIQUES AND TOOLS, IN PARTICULAR THOSE FROM INFORMATION RETRIEVAL AND EXPERT SYSTEMS DEVELOPMENT, PROVIDE SUPPORT FOR ACTIVITIES IN THE DA PROCESS. MANY OF THE TOOLS CAN BE USED IMMEDIATELY WHILE CERTAIN DA ACTIVITIES MAY REQUIRE THE CREATION OF NEW TOOLS. THERE IS, THEREFORE, A DEFINITE POTENTIAL FOR AUTOMATING PARTS OF DA PROVIDED A BASIC FRAMEWORK TO CONDUCT DA EXISTS. THE RLPM WILL BE USED AS THE FRAMEWORK FOR AUTOMATING PRIMITIVE OPERATIONS. OTHER METHODS WILL BE CONSIDERED AND EVALUATED. THE OBJECTIVE IN PHASE I WILL BE TO PROPOSE A DOMAIN ANALYSIS AND REUSE ENVIRONMENT (DARE) ARCHITECTURE THAT SUPPORTS A DA METHODOLOGY. CLEAR UNDERSTANDING OF THE DOMAIN ANALYSIS PROCESS AND A FRAMEWORK FOR STANDARDIZING SOME OF ITS ACTIVITIES. COMMERCIAL APPLICATIONS INCLUDE TAILORING OF THE DARE METHOD AND ENVIRONMENT TO SUPPORT SPECIFIC DOMAINS, DEVELOPMENT OF PLUG-COMPATIBLE TOOLS TO SUPPORT SPECIFIC ASPECTS OF DARE, AND DEVELOPMENT OF DOMAIN SPECIFIC REUSABLE COMPONENTS AND ARCHITECTURES DARE CAN USE FOR APPLICATION DEVELOPMENT.

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Topic#: 91-203 ID#: 9120175
Office: SSTO
Contract #: DAAH0192CR056
PI: SCOTT MYERS

Title: DESIGN OF A ROBOTIC RESEARCH VEHICLE (RRV)

Abstract: THERE IS A GROWING REQUIREMENT TO REMOVE THE SOLDIER FROM THE HAZARDOUS BATTLEFIELD ENVIRONMENT AND REPLACE HIM WITH UNMANNED GROUND VEHICLES. PURE TELEOPERATION REQUIRES CONSTANT OPERATOR ATTENTION DURING "MENIAL TASKS" SUCH AS DRIVING, WHICH ELIMINATES ANY OF THE POTENTIAL FORCE MULTIPLICATION AVAILABLE WITH SINGLE OPERATOR/ MULTI-VEHICLE CONTROL. CURRENTLY DARPA IS ACTIVELY DEVELOPING THE KEY TECHNOLOGIES TO PROVIDE AUTONOMOUS NAVIGATION FUNCTIONS FOR UNMANNED GROUND VEHICLES AND WILL

DEMONSTRATE THIS TECHNOLOGY UNDER A PROGRAM CALLED "DEMO III,. DEMO II WILL USE FOUR SURROGATE SEMI-AUTONOMOUS VEHICLES (SSV) WORKING AUTONOMOUSLY IN A COOPERATIVE MISSION. IN ORDER TO INSURE THE SUCCESS OF DEMO II, EACH OF THE UNIVERSITIES AND KEY ORGANIZATIONS DEVELOPING PIECES OF THE ADVANCED SOFTWARE AND ELECTRONIC HARDWARE REQUIRED NEED A COMMON LABORATORY TESTBED TO PROVE OUT THEIR SOFTWARE ALGORITHMS AND HARDWARE COMPONENTS BEFORE INTEGRATION ONTO THE FIELDED SSV SYSTEMS. THESE COMMON LABORATORY TESTBEDS SHOULD BE EASY TO WORK WITH AND MODIFY AND BE 100% ELECTRONICALLY AND SOFTWARE COMPATIBLE WITH THE FIELDED SSV SYSTEMS TO REDUCE TECHNOLOGY TRANSFER RISK TO THE FIELDED SYSTEMS. RST WILL PROVIDE AN ALL-ELECTRIC, SMALL-SCALE, LOW COST ROBOTIC RESEARCH VEHICLE (RRV) WHICH IS HIGHLY SUITED FOR THE LABORATORY ENVIRONMENT AND IS FUNCTIONALLY IDENTICAL TO THE SSV. THE ROBOTIC RESEARCH VEHICLE WILL ALSO BE CAPABLE OF BEING USED FOR SEVERAL ADDITIONAL APPLICATIONS SUCH AS INTERIOR PHYSICAL SECURITY (GOVERNMENT AND COMMERCIAL), NUCLEAR WASTE CLEANUP, EOD, AND AS A TESTBED FOR FUTURE TECHNOLOGY ADVANCES BY THE RESEARCH COMMUNITY.

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Topic#: 91-157 ID#: 9120707
Office: ESTO
Contract #: DAAH0192CR172
PI: MARK ROOS

Title: EXTENDING AN AUTOMATED MULTIFUNCTION MMIC TEST SYSTEM TO MILLIMETER FREQUENCIES

Abstract: THE OBJECTIVE OF THE PROPOSED PROJECT IS TO EXTEND A CURRENT MMIC TEST SYSTEM ARCHITECTURE TO MILLIMETER WAVE FREQUENCIES. THE ARCHITECTURE IS BASED ON THE INTEGRATION OF CURRENTLY AVAILABLE COMMERCIAL TEST EQUIPMENT WITH CUSTOM HARDWARE TO MINIMIZE REDUNDANT SYSTEM ELEMENTS THAT CONTRIBUTE TO TOTAL SYSTEM COST AND BY STRUCTURING SYSTEM CONTROL AND SOFTWARE TO MAXIMIZE SPEED. THE PROPOSED PHASE I EFFORT SERVES TO VALIDATE THE FEASIBILITY OF A SYSTEM ARCHITECTURE TO ADEQUATELY PERFORM S-PARAMETER, NOISE, POWER AND SPECTRAL ANALYSIS MEASUREMENTS AT MILLIMETER FREQUENCIES. THE EFFORT INCLUDES COMPLETION OF THE SYSTEM DESIGN, MEASUREMENT ACCURACY ESTIMATES, AND COST ESTIMATES FOR A COMPUTER-CONTROLLED MILLIMETER WAVE MMIC TEST STATION. EXPERIMENTAL VERIFICATION OF CRITICAL DESIGN ASSUMPTIONS WILL BE PERFORMED USING AN EXISTING ENGINEERING BRASSBOARD TEST HEAD AND BUS STRUCTURE. REDUCED TEST STATION ACQUISITION COST AND IMPROVED TEST TIMES SUPPORT THE OBJECTIVES OF THE MMIC PROGRAM IN REDUCING TOTAL PRODUCTION COST. REDUCED TEST STATION COST, IMPROVED TEST TIMES AND THE ABILITY TO RAPIDLY CHANGE PROGRAMS WOULD ALSO SERVE TO MEET THE GROWING NEED OF COMMERCIAL PRODUCERS OF MILLIMETER WAVE COMPONENTS TO IMPROVE PRODUCTIVITY.

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Topic#: 91-005 ID#: 9110501
Office:
Contract #: DAAH0191CR186
PI: KENT BACKMAN

Title: FLEXIBLE, DEFORMABLE SURFACES FORMED FROM ARRAYS OF SUB-MILLIMETER SIZED, LINEAR ELECTROMECHANI....

Abstract: WITH THE RECENT ADVENT OF MICRO ELECTRO MECHANICAL SYSTEMS (MEMS), SENSORS AND ACTUATORS WITH CHARACTERISTIC DIMENSIONS IN THE RANGE OF ABOUT .5 TO 1000 MICRONS HAVE BEEN CONSTRUCTED. SUCH ADVANCES OPEN THE POSSIBILITIES FOR INTEGRATION OF A LARGE NUMBER OF SMALL SUBSYSTEMS TO PRODUCE METAMORPHIC MATERIALS AND STRUCTURES. DEVELOPMENT OF SUCH AN INTEGRATED TECHNOLOGY, CONSISTING OF DISTRIBUTED PASSIVE AND ACTIVE SUB-ELEMENTS (STRUCTURES, SENSORS AND ACTUATORS) AND CONTROL, CAN BE APPLICABLE TO ENHANCE THE MULTIMISSION PERFORMANCE OF VARIOUS SYSTEMS. AMONG SUCH FUNCTIONS ARE: ACOUSTIC SUPPRESSION OF SURFACE VIBRATION, TURBULENCE CONTROL, DAMAGE ASSESSMENT, SELF-REPAIRING MATERIAL, RADAR ABSORBING MATERIAL AND CONFORMABLE LIFTING SURFACES. WHILE THERE HAS

BEEN EXTENSIVE DISCUSSION AND IDEAS REGARDING CONCEPT, DESIGN AND FABRICATION OF METAMORPHIC MATERIALS, THE PROGRESS IN THIS FIELD HAS BEEN LIMITED TO THE DESIGN AND DEVELOPMENT OF SUBSYSTEM ELEMENTS (SENSORS AND ACTUATORS). SARCOS RESEARCH CORPORATION (SRC) IN COOPERATION WITH THE CENTER FOR ENGINEERING DESIGN (CED) AT THE UNIVERSITY OF UTAH WOULD LIKE TO APPLY YEARS OF EXPERIENCE IN THE FIELD OF ROBOTICS, CONTROL AND MICRO DEVICES TO DEVELOP SUCH MATERIALS AND STRUCTURES. THIS PROPOSAL WILL INVESTIGATE THE POSSIBLE TYPE AND COMBINATION OF PASSIVE AND ACTIVE DISTRIBUTED SUBELEMENTS AND CONTROL FOR SUCH SYSTEMS. SPECIFICALLY, PHASE I RESEARCH WOULD CONSIST OF DESIGN CONCEPT FOR MICRO ACTUATORS, MICROSENSORS SELECTION, EVALUATION OF HETEROGENEOUS STRUCTURES, SUBSYSTEM ELEMENTS INTEGRATION AND CONTROL CONCEPT DEVELOPMENT. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - REFLECTIVE SURFACES, REDUCE SENSITIVE INSTRUMENTS SHOCK.

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Topic#: 91-097 ID#: 9120506
Office: DSO
Contract #: DAAH0192CR060
PI: DONALD PATTERSON

Title: HALOGEN ASSISTED DIAMOND DEPOSITION

Abstract: OVER THE PAST TWO YEARS, WE HAVE GROWN HIGH QUALITY CVD DIAMOND CRYSTALLITES AS CONFIRMED BY RAMAN SPECTROSCOPY, X-RAY DIFFRACTION, AND SCANNING ELECTRON MICROSCOPY ON A VARIETY OF SUBSTRATES INCLUDING SILICON USING A LOW TEMPERATURE (< 400°C) HALOGEN ASSISTED GROWTH PROCESS THAT IS MORE ENERGY EFFICIENT AND LESS COMPLEX THAN EXISTING HIGH TEMPERATURE CVD PROCESSES THAT GENERALLY REQUIRE SUBSTRATE TEMPERATURES IN EXCESS OF 700°C. THIS PROPOSAL IS FOCUSED ON THE FURTHER DEVELOPMENT OF THIS LOW TEMPERATURE PROCESS WITH THE MAIN EMPHASIS ON THE DEPOSITION OF DIAMOND FILM THERMAL MANAGEMENT COATINGS ON SEMICONDUCTOR DEVICES. DIAMOND *COATED SEMICONDUCTOR* DEVICES WILL OPERATE UNDER FAR GREATER THERMAL LOADS THAN CAN NON-COATED DEVICES. THE PROPOSED WORK PLAN CALLS FOR THE DEVELOPMENT OF LOWER TEMPERATURE DIAMOND DEPOSITION TECHNIQUES THAN ARE CURRENTLY AVAILABLE. THE WORK PLAN FURTHER ENTAILS THE DETERMINATION OF FACTORS WHICH CONTROL THE SIZE OF CRYSTALLITE GROWTH, THAT MINIMIZE THE GROWTH OF AMORPHOUS CARBON AND OTHER IMPURITIES, AND THAT WILL ENABLE THE GROWTH OF CRYSTALLITES TO FORM A CONTINUOUS DIAMOND FILM. ANALYSIS OF THE COMPOSITION AND MORPHOLOGY OF THE DIAMOND COATINGS WILL BE DETERMINED USING RAMAN SPECTROSCOPY, X-RAY DIFFRACTION, AND SCANNING ELECTRON MICROSCOPY THROUGHOUT THIS WORK. LOW TEMPERATURE HALOGEN-ASSISTED CVD DIAMOND WILL ALLOW THIN DIAMOND FILM COATINGS TO BE PLACED ON A WIDE VARIETY OF MATERIALS, INCLUDING FINISHED ELECTRONIC DEVICES. THESE MATERIALS WILL BE GREATLY IMPROVED DUE TO DIAMOND'S EXCELLENT THERMAL CONDUCTIVITY, ELECTRICAL RESISTANCE, HARDNESS, CHEMICAL INERTNESS, AND OTHER PROPERTIES.

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Topic#: 91-174 ID#: 9120990
Office: MTO
Contract #: DAAH0192CR048
PI: KEITH JAMISON

Title: RAMAN SPECTROSCOPY AS AN IN-SITU, REAL TIME TOOL FOR CONTROL OF COMPOUND SEMICONDUCTOR GROWTH

Abstract: RAMAN SPECTROSCOPY IS AN EXCELLENT MEANS FOR NON-CONTACT PROBING OF QUALITY AND TEMPERATURE OF MANY MATERIALS (III-V SEMICONDUCTORS, DIAMONDS, ETC.) WHICH ARE GROWN IN CHEMICAL VAPOR DEPOSITION (CVD) REACTORS. IT CAN MEASURE COMPOSITION, TEMPERATURE, STRAIN, DEGREE OF CRYSTALLINITY, AND PRESENCE OF CONTAMINATION EX-SITU. AS AN OPTICAL PROBE IT CAN READILY PENETRATE THE HIGH PRESSURE GASES WHILE A GROWTH CHAMBER IS IN OPERATION. HOWEVER, THE NORMAL GRATING MONOCHROMETER ASSOCIATED WITH RAMAN SPECTROMETRY IS TOO UNWIELDY AND DOES NOT HAVE THE LIGHT COLLECTION POWER AND THROUGHPUT NEEDED TO BE A TRUE IN-SITU

MONITOR. A UNIQUE AND COMPACT RAMAN SPECTROMETER IS DESCRIBED THAT WILL READILY ADAPT THIS REMARKABLY VERSATILE PROBE TO IN-SITU USE. UNLIKE THE CONVENTIONAL RAMAN SPECTROMETERS IT WILL BE SMALL, RUGGED, USER FRIENDLY, OPTICALLY EFFICIENT, AND INEXPENSIVE; HENCE IT IS READILY ATTACHABLE TO A GROWTH CHAMBER. IN ADDITION, THE RAMAN SYSTEM CAN BE DESIGNATED SO THAT IT CAN OBTAIN A SURFACE IMAGE OF THE RAMAN SIGNAL, THUS IRREGULARITIES IN COMPOSITION AND TEMPERATURE ACROSS A WAFER MAY BE MEASURED. IN PHASE I, WE SHALL USE A CONVENTIONAL RAMAN SYSTEM TO SURVEY THE CRITICAL SENSOR NEEDS FOR GROWTH MONITORING OF ALGAAS, GAAS, INGAAS, AND OTHER MATERIALS AS APPROPRIATE. FROM THIS INFORMATION, A GENERAL PURPOSE COMPACT RAMAN SPECTROMETER WILL BE DESIGNED AND BUILT IN PHASE II. USING INFORMATION FROM THE GENERAL PURPOSE COMPACT RAMAN SPECTROMETER, A COMPACT SMART SENSOR WILL BE DESIGNED FOR DEDICATED APPLICATIONS I.E. COMPOSITION AND TEMPERATURE MEASUREMENT OF ALGAAS. THE CONCLUSION OF PHASE II WILL BE THE CONSTRUCTION AND DELIVERY OF SMART SENSORS WHICH CAN BE ATTACHED TO COMMERCIAL CVD REACTORS. THESE WILL PROVIDE FEEDBACK SIGNALS TO CONTROL THE TEMPERATURE, FLOW OF REACTANT MATERIALS, ETC., TO MAINTAIN THE GROWTH WITHIN THE DESIRED PARAMETERS. IMPROVEMENTS IN COMPOSITION, TEMPERATURE AND STRAIN FOR FEEDBACK CONTROL OF CHEMICAL VAPOR DEPOSITION GROWTH OF SEMICONDUCTORS WILL IMPROVE THE QUALITY OF THE MATERIAL BEING GROWN. AT THE COMPLETION OF PHASE II, A MARKETABLE IN-SITU PROBE FOR TEMPERATURE, STRAIN AND COMPOSITION MEASUREMENT OF CVD GROWN MATERIALS WILL BE AVAILABLE FOR PRODUCTION.

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Topic#: 91-061 ID#: 9110634
Office:
Contract #: DAAH0191CR161
PI: DAVID WELFORD

Title: EXCITED STATE ABSORPTION PUMPED UPCONVERSION LASERS

Abstract: WE PROPOSE A NEW UPCONVERSION PUMPING SCHEME CALLED EXCITED STATE ABSORPTION (ESA) PUMPING WHICH CAN BE DESCRIBED AS A TWO PHOTON RESONANT PUMPING PROCESS IN WHICH THE SECOND PHOTON IS INTERNALLY GENERATED (SIMILAR TO ION-PAIR INTERACTIONS IN WHICH THE ENERGY MAY BE TRANSFERRED WITHOUT PHOTON EMISSION). WE PROPOSE TO IDENTIFY PUMPING PATHS AND INVESTIGATE LASER OPERATION FOR BOTH ESA PUMPING AND PHOTON AVALANCHE UPCONVERSION IN ND:YLF AND ER:YLF. THESE TWO CLASSES OF UPCONVERSION LASERS OFFER THE POTENTIAL FOR NEW UPCONVERSION LASER WAVELENGTHS AND OPERATION AT HIGHER TEMPERATURES THAN MORE CONVENTIONAL MULTI-PHOTON PUMPED UPCONVERSION LASERS. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE POTENTIAL APPLICATIONS FOR DIODE-PUMPED UPCONVERSION LASERS INCLUDE: 1) REPROGRAPHIC AND IMAGING APPLICATIONS REQUIRING COMPACT AND EFFICIENT SOURCES OF THE PRIMARY COLORS;2) SOURCES FOR USE IN OPTICAL STORAGE MEDIA THAT REQUIRE DIFFERENT BLUE AND NEAR-UV WAVELENGTHS FOR READ, WRITE, AND ERASE FUNCTIONS; AND 3) GENERAL SCIENTIFIC LASER SOURCE APPLICATIONS FOR THE SPECTROSCOPIC INVESTIGATION OF OTHER MATERIALS.

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Topic#: 91-064 ID#: 9110633
Office:
Contract #: DAAH0191CR202
PI: DAVID WELFORD

Title: NOVEL EYE-SAFE DIODE-LASER LIDAR

Abstract: THE DEVELOPMENT OF GAINASP SEMICONDUCTOR DIODE LASERS FOR FIBER-OPTIC COMMUNICATION SYSTEMS AT 1.55 UM HAS LED TO CONSIDERATION OF THE POTENTIAL USE OF THESE DEVICES IN COMPACT, EYE-SAFE LASER RADAR SYSTEMS. WE PROPOSE A NOVEL LIDAR TECHNIQUE THAT CAN MAKE EFFICIENT USE OF THE NOVEL PROPERTIES OF CW DIODE LASERS, IN ORDER TO PROVIDE BOTH RANGE AND DOPPLER DATA ON TARGETS. IN THE PHASE I EFFORT WE WILL CONDUCT A MODELING STUDY OF THE PROPOSED TECHNIQUE, PERFORM AN INITIAL LABORATORY DEMONSTRATION USING A COMMERCIAL LASER, AND ASSESS THE FUTURE PROSPECTS FOR DEVELOPMENT OF HIGH-POWER,

LONG-WAVELENGTH DIODE LASERS. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS- COMMERCIAL APPLICATIONS COULD INCLUDE HAND-HELD LIDARS FOR TRAFFIC MONITORING, SENSORS FOR MACHINE AUTOMATION AND VEHICLE-MOUNTED DETECTORS FOR AUTOMATIC BRAKING SYSTEMS.

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Topic#: 91-227 ID#: 9121095
Office: MICOM
Contract #: DAAH0192CR188
PI: MADHU ACHAREKAR

Title: DEVELOPMENT OF COMPACT HARDENED DYE LASER

Abstract: CURRENT HIGH-POWERED DYE LASERS, PRESENTLY AVAILABLE, REQUIRE LARGE, HEAVY AND CUMBERSOME POWER SUPPLIES. WHILE THESE LASERS MAY BE APPROPRIATE IN A RESEARCH SETTING, THEY DO NOT LEND THEMSELVES READILY TO A MOBILE ENVIRONMENT IN WHICH A RUGGED, COMPACT, TUNABLE LASER OPERATING IN THE VISIBLE SPECTRAL REGION IS REQUIRED. UNDER RECENTLY COMPLETED SBIR CONTRACTS, SCHWARTZ ELECTRO-OPTICS, INC. (SEO) HAS DEVELOPED A NOVEL, SELF-CONTAINED, CHEMICALLY-PUMPED SOLID STATE LASER. THE CHEMICAL REACTION PROVIDES THE NECESSARY OPTICAL PUMPING OF THE SOLID STATE LASER MATERIAL, THEREBY ELIMINATING THE REQUIREMENT OF HIGH VOLTAGE POWER SUPPLIES AND COOLING SYSTEMS. SEO PROPOSES IN THE PHASE I PROGRAM TO INCORPORATE AND EXPAND UPON THE USE OF CHEMICALLY PUMPING TECHNIQUES WITH SPECIFIC EMPHASIS ON THE DEVELOPMENT OF A HIGH ENERGY, VISIBLE DYE LASER. A CHEMICAL PUMPED DYE LASER OF APPROXIMATE VOLUME OF 1 CUBIC FT., PROVIDING OUTPUT ENERGY 30-300 J/PULSE WILL BE DESIGNED, FABRICATED AND TESTED DURING THIS PHASE I STUDY. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE DEVELOPMENT OF A COMPACT, CHEMICALLY-PUMPED DYE LASER OFFERS A LIGHT WEIGHT, COMPACT TUNABLE LASER SOURCE. ELIMINATED WILL BE THE NEED FOR LARGE, HEAVY AND COSTLY POWER SUPPLIES WHICH ARE PRESENTLY REQUIRED. A CHEMICAL PUMPED DYE LASER OF APPROXIMATE VOLUME OF 1 CUBIC FT., PROVIDING OUTPUT ENERGY 30-300J/PULSE WILL BE DESIGNED, FABRICATED AND TESTED DURING THIS PHASE I STUDY.

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Topic#: 91-235 ID#: 9120615
Office: ASTO
Contract #: DAAH0192CR097
PI: JOHN FLINT

Title: AIRBORNE COHERENT LIDAR SYSTEM FOR THE DETECTION OF CLEAR AIR TURBULENCE

Abstract: CLEAR AIR TURBULENCE (CAT), WHICH CAN CONTAIN DIFFERENTIAL WIND VELOCITIES OF 100'S OF METERS PER SECOND, ARE A SEVERE DANGER TO AIRCRAFT WHICH ENCOUNTER THEM WITHOUT WARNING. WE DESCRIBE AN EYE-SAFE LIDAR SYSTEM DESIGNED TO PROVIDE 10 SECONDS OF WARNING TO AN AIRCRAFT TRAVELING AT 400 KNOTS. THE SENSOR DETECTS THE PRESENCE OF AIR TURBULENCE BY MEASURING THE VARIANCE IN THE DOPPLER-SHIFTED BACKSCATTER OFF AEROSOLS IN THE VICINITY OF THE FLIGHT PATH. EXAMINING THE VARIANCE OF THE DOPPLER SPECTRUM ALLOWS FOR THE DETECTION OF TURBULENCE IN REAL-TIME. THE PHASE I EFFORT WILL SPECIFICALLY DEFINE THE RECOMMENDED IMPLEMENTATION, PREDICTED PERFORMANCE AND PRACTICAL UTILITY OF THE PROPOSED TECHNOLOGY FOR THE DETECTION AND AVOIDANCE OF CLEAR AIR TURBULENCE HAZARDS. IN SUPPORT OF THIS GOAL, THE PHASE I ACTIVITY WILL (A) DEFINE THE PERFORMANCE SPECS FOR EACH OF THE CRITICAL COMPONENTS/SUBASSEMBLIES IN THE SYSTEM, (B) INCLUDE A PRELIMINARY DESIGN OF THE MID-IR SOLID-STATE LIDAR TRANSCEIVER AND REAL-TIME SIGNAL/DATA PROCESSOR, AND (C) DEVELOP STRATEGIES FOR OPTIMAL UTILIZATION OF CAT DETECTION DATA FOR AIRBORNE PLATFORMS. APPLICATIONS OF THE PROPOSED RESEARCH RELATE TO TWO AREAS: (1) THE FURTHER DEVELOPMENT OF MID-INFRARED SOLID-STATE LASER TECHNOLOGY FOR SCIENTIFIC STUDIES, AND (2) USE OF THE REMOTE SENSING TECHNOLOGY IN ATMOSPHERIC RESEARCH, COMMERCIAL AVIATION, AND POLLUTION/TOXIC GAS MONITORING.

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Topic#: 91-088 ID#: 9120906
Office: NMRO
Contract #: DAAH0192CR059
PI: CHARLES BERGAN

Title: DESIGN FOR MINIATURIZED, RUGGEDIZED, LOW-COST SEISMIC STATION FOR DEPLOYMENT IN THIRD-WORLD ENVIRONMENTS

Abstract: SCIENCE HORIZONS' PROPOSES TO DESIGN A RUGGED, MINIATURIZED, LOW-COST SEISMIC STATION WITH THE DESIGN BASED ON THE CIM TI COMMUNICATIONS PROCESSOR. THE DESIGN WILL SATISFY THE FOLLOWING THREE OPERATING SCENARIOS. IN THE FIRST, THE CIM II FUNCTIONS SIMPLY AS A DATA LOGGER WITH NO MOVING PARTS. IN THE SECOND, THE CIM II FUNCTIONS NOT ONLY AS A DATA LOGGER, BUT ALSO AS A COMMUNICATIONS INTERFACE MODULE WHEREBY THE DIGITAL DATA ARE CONTINUOUSLY SENT TO AN ANALYSIS SITE. IN THE THIRD, THE CIM II FUNCTIONS NOT ONLY AS A DATA LOGGER, BUT ALSO AS AN EVENT DETECTOR AND SEGMENTOR. ONLY SEGMENTED DATA IS INITIALLY TRANSMITTED TO THE ANALYSIS SITE. THE ANALYSIS SITE IS THEN ABLE TO REQUEST CONTINUOUS DATA FROM ANY PORTION OF THE PREVIOUS TWENTY (20) DAYS IN ORDER TO SUPPLEMENT THE DATA OBTAINED FROM THE SEGMENTED WAVE FORMS. WE INTEND TO DESIGN A SINGLE DATA ACQUISITION SYSTEM THAT IS CAPABLE OF OPERATING UNDER ANY OF THESE THREE SCENARIOS. THE DESIGN WILL USE COMMERCIAL, OFF-THE-SHELF PRODUCTS WHICH WILL SUBSTANTIALLY REDUCE THE COST AND DECREASE THE DELIVERY TIME OF THE PRODUCTION UNITS.

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Topic#: 91-063 ID#: 9110013
Office:
Contract #: DAAH0191CR196
PI: JONAH JACOB

Title: ELECTRODLESS FLASHLAMPS FOR PUMPING SOLID STATE LASERS

Abstract: THE OBJECTIVE OF THIS PROPOSED EFFORT IS TO DEVELOP ADVANCED FLASHLAMP TECHNOLOGY WHICH CAN BE USED TO 1) INCREASE THE OVERALL EFFICIENCY OF SOLID-STATE LASERS BY A FACTOR OF 5 TO 10 OVER THAT ACHIEVABLE WITH CONVENTIONAL XENON FLASHLAMPS, 2) EXTEND FLASHLAMP LIFE TO 10 SHOTS; AND 3) REDUCE THE COST OF EFFICIENT SOLID-STATE LASER PUMP SOURCES TO PROVIDE AN AFFORDABLE CAPITAL COST FOR THE OVERALL LASER SYSTEM. SPECIFICALLY, AN ADVANCED FLASHLAMP TECHNOLOGY WILL BE DEVELOPED FOR EFFICIENTLY PUMPING THE CR:LISRA1F LASER WHOSE OUTPUT FREQUENCY CAN BE EFFICIENTLY DOUBLED INTO THE LUBE REGION OF THE SPECTRUM AND MADE TO MATCH NARROW BAND ATOMIC RESONANCE FILTERS FOR SUBMARINE LASER COMMUNICATIONS. IN THE PHASE I EFFORT, A FINAL ENGINEERING DESIGN FOR THESE ADVANCED FLASHLAMPS WILL BE DEVELOPED BASED ON EXTENSIVE MODELING OF THE RADIATIVE AND DISCHARGE CHARACTERISTICS OF THE FLASHLAMPS USING EXISTING SRL COMPUTER CODES. IN THE PHASE II EFFORT, SEVERAL ADVANCED FLASHLAMPS WILL BE TESTED AND OVERALL RADIATIVE EFFICIENCY INTO THE PUMP BANDS OF CR:LISRA1F WILL BE MEASURED. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - EFFICIENT, RELIABLE SOLID STATE LASERS WHICH CAN BE TUNED IN THE RANGE OF 0.8 TO 1.0 UM HAVE A BROAD SPECTRUM OF MILITARY AND COMMERCIAL APPLICATIONS. MILITARY APPLICATIONS INCLUDE FREQUENCY-DOUBLED OPERATION OF THE LASER IN THE BLUE GREEN REGION OF THE SPECTRUM FOR UNDERWATER DETECTION AND COMMUNICATION APPLICATIONS. COMMERCIAL APPLICATIONS INCLUDE LASER SURGERY (LASER LITHOTRIPSY, RADIAL KEROTOMY, LASER ANGIOPLASTY), LASER METALWORKING AND SUBMICRON X-RAY LITHOGRAPHY.

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Topic#: 91-112 ID#: 9120052
Office: MTO
Contract #: DAAH0192CR093
PI: DANIEL BIRX

Title: EFFICIENT, RELIABLE ARF LASER DRIVERS FOR 193 NM PROJECTION LITHOGRAPHY

Abstract: THE OBJECTIVE OF THIS EFFORT IS TO DEVELOP NEW ARF LASER TECHNOLOGY FOR USE IN 193 NM

PROJECTION LITHOGRAPHIC SYSTEMS. THESE LITHOGRAPHIC SYSTEMS WILL ENABLE COST-EFFECTIVE FABRICATION OF MILITARY APPLICATION SPECIFIC INTEGRATED CIRCUITS WITH FEATURE SIZES AT OR BELOW 0.25μM. IN THE PROPOSED PROGRAM, NEW ALL-SOLID-STATE ARF LASER DRIVER TECHNOLOGY WILL BE DEVELOPED TO REPLACE THYRATRON-BASED DRIVERS USED IN CURRENT, COMMERCIALLY AVAILABLE ARF LASERS. THIS NEW ALL-SOLID-STATE TECHNOLOGY WILL EXTEND DRIVER LIFETIME BY A FACTOR OF 20 (TO 6 X 10(10) SHOTS) AND WILL FEATURE NOVEL CIRCUITS WHICH RECOVER ENERGY REFLECTED FROM THE TIME-VARYING DISCHARGE LOAD. THE RECOVERED ENERGY WILL BE STORED AND THEN REUSED ON THE NEXT DISCHARGE PULSE. THESE ENERGY RECOVERY CIRCUITS WILL EXTEND LASER DISCHARGE ELECTRODE LIFE AND INCREASE OVERALL LASER EFFICIENCY. THIS NEW DRIVER WILL ALSO BE DESIGNED TO INCREASE ARF LASER REPETITION RATE FROM 400 PPS TO 1000 PPS, INCREASE LASER DUTY FACTOR AND THEREBY EXTEND THE LIFE OF THE DEEP-UV LASER RESONATOR OPTICS. THIS ALL-SOLID-STATE ARF LASER DRIVER TECHNOLOGY IS BASED ON SCR-COMMUTATED, NONLINEAR MAGNETIC PULSE COMPRESSION COUPLED WITH A NOVEL FRACTIONAL-TURN TRANSFORMER WHICH ENABLES AN EXTREMELY COMPACT, LOW COST, MODULAR DESIGN. IN THE PHASE I EFFORT, FINAL DESIGN SPECIFICATIONS FOR THIS DRIVER WILL BE ESTABLISHED AND A DETAILED ENGINEERING DESIGN OF THE DRIVER WILL BE COMPLETED. IN THE PHASE II EFFORT, THIS DRIVER WILL BE FABRICATED AND EXTENSIVELY TESTED. THE NEW ALL-SOLID-STATE PULSED POWER TECHNOLOGY TO BE DEVELOPED IN THIS EFFORT WILL EXTEND ARF LASER DRIVER LIFETIME BY A FACTOR OF 20 OVER PREVIOUS THYRATRON-BASED DESIGNS, EXTEND LASER DISCHARGE ELECTRODE LIFETIME AND OPTICS LIFETIME AND INCREASE LASER POWER AND EFFICIENCY. POTENTIAL COMMERCIAL APPLICATIONS INCLUDE USE OF THESE DRIVERS IN THE DEVELOPMENT OF RELIABLE RARE GAS HALIDE LASERS FOR METAL-WORKING (WELDING, CUTTING, HEAT TREATING), MEDICINE (NEUROSURGERY LITHOTRIPSY, ANGIOPLASTY, CORNEAL SCULPTING) AND DEEP-UV PROJECTION LITHOGRAPHY.

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Topic#: 91-227
Office: MICOM
Contract #: DAAH0192CR067
PI: STEPHEN FULGHUM

ID#: 9120453

Title: AN ALL-SOLID-STATE FLASHLAMP DRIVER FOR INCREASED DYE LASER EFFICIENCY

Abstract: THE OBJECTIVE OF THIS PHASE I SBIR PROGRAM IS TO DEVELOP NEW, ALL-SOLID-STATE FLASHLAMP DRIVER TECHNOLOGY WHICH INCREASES THE EFFICIENCY (TO 2%) AND LIFETIME (TO 109 SHOTS) OF FLASHLAMP-PUMPED DYE LASERS. THIS NEW DRIVER TECHNOLOGY WILL DELIVER TAILORED DRIVE PULSES TO THE FLASHLAMP LOAD WHICH ESTABLISH AND MAINTAIN OPTIMUM FLASHLAMP DISCHARGE CONDITIONS DURING THE BULK OF THE DISCHARGE PULSE. THIS NEW ALL-SOLID-STATE DRIVER TECHNOLOGY IS BASED ON SCR-COMMUTATED NONLINEAR MAGNETIC PULSE COMPRESSION CIRCUITS WHICH HAVE DEMONSTRATED >10(10) SHOT RELIABILITY IN SIMILAR APPLICATIONS. IN THE PHASE I PROGRAM, FLASHLAMP EXPERIMENTS WILL BE CONDUCTED WHICH COMPARE LAMP SPECTRUM, SPECTRAL EFFICIENCY AND TOTAL ENERGY OUTPUT FOR TAILORED AND UNTAILORED DRIVE PULSES. IN THE PHASE II EFFORT, AN OPTIMIZED ALL-SOLID-STATE DRIVER WILL BE FABRICATED AND USED TO INCREASE THE EFFICIENCY AND LIFETIME OF A HIGH ENERGY, FLASHLAMP-PUMPED DYE LASER. THE ALL-SOLID-STATE FLASHLAMP DRIVER TECHNOLOGY TO BE DEVELOPED IN THIS PROPOSED EFFORT WILL INCREASE THE EFFICIENCY AND EXTEND THE LIFETIME OF HIGH ENERGY FLASHLAMPS USED TO POWER DYE LASERS. FLASHLAMP-PUMPED DYE LASERS HAVE A BROAD SPECTRUM OF MEDICAL APPLICATIONS INCLUDING USES IN DERMATOLOGY, IN UROLOGY FOR LITHOTRIPSY AND IN LASER KEROTOMY.

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Topic#: 91-036
Office:
Contract #: DAAH0191CR278
PI: DOUGLAS GILMORE

ID#: 9110650

Title: BUILDING FORTRAN-LINDA(R)

Abstract: THE MAIN IMPEDIMENT TO THE USE OF PARALLEL AND DISTRIBUTED COMPUTING IS THE LACK

OF PROPER HIGH-LEVEL PARALLEL PROGRAMMING ENVIRONMENT. THE POTENTIAL OF PARALLEL MACHINES WILL NEVER BE TAPPED IF THEY CANNOT BE PROGRAMMED EFFECTIVELY AND EASILY. FORTRAN-LINDA IS A PROGRAMMING LANGUAGE FOR BUILDING DISTRIBUTED AND PARALLEL PROGRAMS. IT COMBINES A STANDARD SCIENTIFIC PROGRAMMING LANGUAGE (FORTRAN)WITH A POWERFUL COORDINATION LANGUAGE (LINDA). THE FORTAN-LINDA PRODUCT WILL CONSIST OF TWO PIECES OF SOFTWARE: A FORTRAN-LINDA PRECOMPILER AND A FORTRAN-LINDA OPTIMIZING LINKER. THESE TWO WORK IN TANDEM WITH EXISTING LINDA RUNTIME LIBRARIES TO SUPPORT PARALLEL PROGRAMMING ON A WIDE RANGE OF PARALLEL COMPUTERS AND DISTRIBUTED COMPUTER NETWORKS. WE PROPOSE TO BEGIN DEVELOPMENT OF FORTRAN-LINDA. PHASE I IS LARGELY DEVOTED TO DESIGN OF FUNCTIONALITY AND INTERFACES AND TO THE CONSTRUCTION OF A PROTOTYPE PRECOMPILER. IF SUCCESSFUL, THIS WILL LEAD TO A FULL IMPLEMENTATION IN PHASE II. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THIS WORK WILL LEAD TO A PARALLEL PROGRAMMING TOOL AIMED DIRECTLY AT THE LARGE BODY OF SCIENTISTS AND ENGINEERS FOR WHOM FORTRAN IS THE COMPUTATIONAL LANGUAGE OF CHOICE. TO DATE, MOST PARALLEL LANGUAGES HAVE AVOIDED THIS CLASS OF USER, DESPITE THE FACT THAT THEY ARE FACED WITH SOLVING MANY OF THE MOST DIFFICULT AND CRUCIAL COMPUTING PROBLEMS WE KNOW. FORTRAN-LINDA WILL OPEN THE WORLD OF PARALLEL COMPUTING FOR THESE POWER USERS.

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Topic#: 91-036 ID#: 9110688
Office:
Contract #: DAAH0191CR279
PI: DOUGLAS GILMORE

Title: COMPILER OPTIMIZATIONS, EXECUTION ENVIRONMENTS, AND PERFORMANCE ANALYSIS AND TUNING TOOLS FOR....

Abstract: IN THE LAST FEW YEARS, THE PERFORMANCE OF MICROPROCESSORS USED IN WORKSTATIONS HAS INCREASED DRAMATICALLY, AND ADVANCES IN VLSI TECHNOLOGY ASSURE CONTINUING PERFORMANCE IMPROVEMENT IN THE FUTURE. SCIENTIFIC COMPUTING ASSOCIATES, INC. HAS MADE SIGNIFICANT PROGRESS IN THE DEVELOPMENT OF AN EFFICIENT IMPLEMENTATION OF THE LINDA COORDINATION LANGUAGE ALLOWING PARALLEL PROGRAMS TO BE RUN ON A NETWORK OF WORKSTATIONS. THIS PROJECT WILL DESIGN AND IMPLEMENT VARIOUS NETWORK LINDA OPTIMIZATION STRATEGIES TO IMPROVE THE EFFICIENCY AND SCALABILITY OF NETWORK LINDA APPLICATION PROGRAMS. MANY OF THESE OPTIMIZATIONS ARE DIRECTLY APPLICABLE TO OTHER DISTRIBUTED MEMORY IMPLEMENTATIONS OF LINDA FOR MASSIVELY PARALLEL PROCESSORS. TO AID THE DESIGN OF THE OPTIMIZATIONS AND TO ALSO PROVIDE A PERFORMANCE ANALYSIS TOOL FOR PROGRAMMERS DEVELOPING APPLICATIONS USING NETWORK LINDA, A PROFILING TOOL WILL BE DESIGNED AND IMPLEMENTED. FINALLY, A NETWORK LINDA EXECUTION DAEMON WILL BE DEVELOPED, ALLOWING LINDA PROGRAMS TO BE EASILY AND EFFICIENTLY INVOKED, WHILE MINIMIZING THE IMPACT OF LINDA COMPUTATIONS ON OTHER USERS OF THE NETWORK. THE COMBINATION OF PROGRAMMING CONVENIENCE PROVIDED BY LINDA WITH THE RAW COMPUTE POWER NASCENT IN MODERN WORKSTATION NETWORKS PROVIDES AN UNPARALLEL TOOL FOR LOW-COST, HIGH-PERFORMANCE COMPUTING. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - LINDA IS RAPIDLY BECOMING A STANDARD TOOL FOR PROGRAMMING MIMD SYSTEMS. LOCAL-AREA NETWORKS (LANS) OF WORKSTATIONS ARE OBVIOUS, IN-PLACE (AND THEREFORE INEXPENSIVE), SCALABLE, AND LARGELY UNTAPPED MIMD RESOURCES THAT CAN BE EXPLOITED BY USING SCIENTIFIC'S NETWORK LINDA SYSTEM. THIS PROPOSAL WILL LEAD TO SIGNIFICANT IMPROVEMENTS THAT SHOULD ENABLE PROGRAMMERS TO EFFECTIVELY AND ROUTINELY TURN LANS INTO VIRTUAL "HYPERCOMPUTERS."

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Topic#: 91-079 ID#: 9110507
Office:
Contract #: DAAH0191CR184
PI: HAROLD GRUBIN

Title: DEVICE PHENOMENA UNIQUE TO SUB-MICROMETER DEVICES
Abstract: THE ESTABLISHMENT OF GUIDING DESIGN PRINCIPLES FOR THE OPERATION OF QUANTUM CONFINED DEVICES IS NECESSARY FOR MAKING ULTRA-SMALL DEVICES AND FOR PRODUCING MORE FUNCTIONALITY PER UNIT AREA OF CHIP WHEN THE DEVICE SIZE IS UNCHANGED. SUCH GUIDING PRINCIPLES REQUIRE A QUANTUM MECHANICALLY BASED SET OF EQUATIONS THAT INCORPORATE MANY PARTICLE STATISTICS. A MAJOR OPPORTUNITY EXISTS FOR INTRODUCING INTO THE SEMICONDUCTOR DEVICE COMMUNITY, QUANTUM MECHANICALLY CORRECT ALGORITHMS THAT INCORPORATE MANY PARTICLE EFFECTS, INCLUDING ELECTRON AND HOLE TRANSPORT, AND DISSIPATION. SCIENTIFIC RESEARCH ASSOCIATES, INC., HAS DEVELOPED AN INNOVATIVE TIME DEPENDENT QUANTUM MECHANICAL ALGORITHM INCORPORATING THE ABOVE CONTRIBUTIONS THAT PERMITS STEADY STATE COMPUTATIONS TO BE COMPLETED IN LESS THAN 15 CRAY CPU SECONDS THE ESTABLISHMENT OF QUANTUM DEVICE GUIDELINES ARE NOW POSSIBLE. THIS PROPOSAL DESCRIBES A PROGRAM FOR IMPLEMENTING AND EXPANDING THE ALGORITHM TO ADDRESS THE COMBINED QUESTIONS OF HOW MUCH AND HOW FAST CAN CHARGE BE TRANSPORTED THROUGH QUANTUM DEVICES. THE BASIC ISSUE OF DEVICE SPEED IS TO BE DETERMINED DURING PHASE I FOR A SPECIFIC CLASS OF II-IV AND II-VI RESONANT TUNNELING DEVICES UNDER DIRECTED ELECTRICAL EXCITATION AND INDUCED PHOTO-EXCITATION; AND DURING A PHASE II FOR THREE TERMINAL QUANTUM STRUCTURES. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - SRA'S NUMERICAL BREAKTHROUGH: 1) WILL PERMIT THE EXPLORATION OF PHENOMENA THAT CAN SIGNIFICANTLY INFLUENCE EXISTING ELECTRONIC DEVICE PERFORMANCE AS THE DEVICE IS REDUCED IN DIMENSION; 2) IS CAPABLE OF EXAMINING NEW AND NOVEL PHENOMENA IN ULTRA-SUBMICRON STRUCTURES; AND 3) WILL PERMIT THE INSERTION OF THE NEWLY DEVELOPED QUANTUM MECHANICAL ALGORITHM INTO WORKSTATIONS USED BY THE SEMICONDUCTOR COMMUNITY.

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Topic#: 91-148 ID#: 9120859
Office: ASTO
Contract #: DAAH0192CR187
PI: R. MEHRA

Title: NONLINEAR DETECTION OF WEAK SIGNALS IN CLUTTER USING GENERALIZED NEURAL NETWORKS
Abstract: THE MAJOR OBJECTIVE OF THE PROPOSED R&D EFFORT IS TO INVESTIGATE THE PERFORMANCE OF SEVERAL INNOVATIVE NEURAL NETWORK APPROACHES FOR THE DETECTION OF WEAK SIGNALS IN CLUTTER. DURING PHASE I, DIFFERENT MODELS FOR SIGNAL AND CLUTTER WILL BE USED TO GENERATE SIMULATED DATA AND TO COMPARE THE PERFORMANCE OF STANDARD METHOD WITH THAT OF GENERALIZED NEURAL NETWORKS (GNN). SIGNALS WILL BE MODELED BOTH AS NARROW BAND AND AS CHAOTIC TIME SERIES, WHEREAS CLUTTER WILL BE MODELED AS BOTH NARROW BAND AND WIDE BAND. IN ADDITION TO ONE DIMENSIONAL AMPLITUDE VERSUS DOPPLER FREQUENCY SIGNALS, TWO DIMENSIONAL SIGNALS INVOLVING RANGE AND DOPPLER FREQUENCY WILL ALSO BE TESTED. THE FOLLOWING GNN APPROACHES WILL BE CONSIDERED: (I) INTELAHEDRON BASED ON STATISTICAL PATTERN RECOGNITION (II) RADIAL BASIS FUNCTIONS (III) PROJECTION PURSUIT (IV) GROUP METHOD OF DATA HANDLING (V) STATE SPACE MARKOV MODELS. TWO OF THE ABOVE APPROACHES (INTELAHEDRON AND PROJECTION PURSUIT), WILL BE DEVELOPED AND COMPARED TO STANDARD METHODS USING MONTE CARLO SIMULATIONS ON THE ABOVE CASES. THE PROPOSED R&D EFFORT WILL BE SUPPORTED BY RAYTHEON COMPANY'S RADAR EQUIPMENT DIVISION. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE SUCCESS OF PHASE I R&D WILL LEAD TO A MORE ROBUST DETECTION CAPABILITY UNDER COMPLEX CLUTTER AND ECM ENVIRONMENTS. THE BENEFITS WILL ACCRUE IN TERMS OF TRACKING MORE TARGETS AT LONGER RANGES USING LESS RADAR ENERGY. THE EVENTUAL GOAL OF THIS EFFORT IS THE DEVELOPMENT OF UNIVERSALLY APPLICABLE PLUG-IN, TRAINABLE MODULE OF TARGET DETECTION. COMMERCIAL APPLICATIONS WILL BE IN FIELDS SUCH AS AIR TRAFFIC CONTROL, COMMERCIAL SONAR AND FAILURE DETECTION IN COMPLEX MECHANICAL AND ELECTRICAL EQUIPMENT USING VIBRATION DATA.

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Contract #: DAAH0192CR072
PI: EMMANUEL KANTERAKIS
Title: EQUIPMENT OF TESTING LIQUID CRYSTAL ACTIVE MATRIX DISPLAY CHANNELS
Abstract: AN OPTICAL SUBTRACTION TECHNIQUE IS PROPOSED FOR TESTING THE ACTIVE MATRIX PIXEL PERFORMANCE WITHOUT NEED FOR LIQUID CRYSTAL FILLING. SINCE THE ACTIVE MATRIX ARRAY IS A BINARY OBJECT IN THE OPTICAL SENSE, AN OPTICAL SUBTRACTION TECHNIQUE IS VERY SUITABLE FOR DETECTING THE ACTIVE MATRIX DEFECTS. FOR TESTING AN ACTIVE MATRIX WITH BROKEN OR SHORTED LINES, THE PROPOSED TECHNIQUE WILL PROVIDE A REAL-TIME AUTOMATED SYSTEM THAT CONNECTS WITH AN ELECTRONIC IMAGING SYSTEM AND A COMPUTER THAT CAN BE UTILIZED IN THE MANUFACTURING PROCESS. THE DEFECTS OF A MATRIX PANEL WILL BE IMAGED BY THE ELECTRONIC IMAGING SYSTEM, DISPLAYED ON A MONITOR AND PROCESSED BY THE COMPUTER SO THAT THE TYPES AND LOCATIONS OF DEFECTS WILL BE AUTOMATICALLY PRESENTED BY THE EQUIPMENT. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE RESEARCH AND DEVELOPMENT PROPOSED IN THIS PROPOSAL WILL PROVIDE A REAL TIME OPTICAL SYSTEM FOR TESTING PIXEL PERFORMANCE OF AN ACTIVE MATRIX ARRAY. ASSOCIATED WITH THIS APPROACH, MAJOR MILITARY AND INDUSTRIAL BENEFITS ARE ANTICIPATED.

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Contract #: DAAH0192CR095
PI: BENJAMIN FRIEDLANDER
Title: VSAR: A NEW SENSOR FOR DETECTING LOW RCS GROUND TARGETS
Abstract: THE VELOCITY SAR (VSAR) IS A NOVEL RADAR SYSTEM WHICH COMBINES THE HIGH-RESOLUTION IMAGING CAPABILITY OF SYNTHETIC APERTURE RADAR (SAR) WITH VELOCITY DISCRIMINATION. THE PROPOSED SYSTEM MAKES IT POSSIBLE TO "FILTER OUT" VARIOUS FEATURES OF THE SURVEILLANCE SCENE BASED ON THEIR MOTION. THEREFORE, THE SYSTEM PROVIDES A VERY POWERFUL CLUTTER REJECTION CAPABILITY WHICH CAN BE USED FOR DETECTING LOW RCS GROUND TARGETS MOVING AT LOW SPEEDS. THE VSAR COMBINES THE CLUTTER REJECTION PROPERTIES OF SAR AND MTI SYSTEMS IN A UNIQUE WAY, TO PROVIDE AN UNPARALLELED PERFORMANCE ADVANTAGE. THE VSAR SYSTEM IS CURRENTLY BEING DEVELOPED FOR OCEAN SURVEILLANCE APPLICATIONS, WHERE IT WAS USED TO RECONSTRUCT THE THREE DIMENSIONAL IMAGE (RANGE, AZIMUTH, AND VELOCITY) OF THE TIME VARYING OCEAN SURFACE. THE OBJECTIVE OF THE PROPOSED PHASE I PROJECT IS TO EVALUATE, BY A COMBINATION OF ANALYSIS AND SIMULATION, THE FEASIBILITY OF USING THIS TYPE OF A SYSTEM TO DETECT NEXT GENERATION LOW RCS GROUND TARGETS. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE VSAR HAS IMMEDIATE APPLICATIONS FOR SPACE AND AIRBORNE SURVEILLANCE, INCLUDING: WIDE AREA OCEAN SURVEILLANCE, HIGH RESOLUTION IMAGING OF MOVING TARGETS AND TROOPS IN TACTICAL SITUATIONS, AND A WIDE RANGE OF INTELLIGENCE MISSIONS. AN ALL-WEATHER DAY/NIGHT HIGH RESOLUTION IMAGING SENSOR SUCH AS THE VSAR IS EXPECTED TO HAVE NUMEROUS APPLICATIONS IN STRATEGIC AND TACTICAL SURVEILLANCE SYSTEMS. THE VSAR IS EXPECTED TO BE VERY USEFUL FOR COMMERCIAL APPLICATIONS RELATED TO REMOTE SENSING OF THE OCEAN AND AIRCRAFT TRAFFIC CONTROL.

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Topic#: 91-177 ID#: 9120789
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Contract #: DAAH0192CR103
PI: SCOTT EVANS
Title: GENERIC READOUT FOR INFRARED FOCAL PLANE ARRAYS
Abstract: PROPOSED IS A MEANS OF PRODUCING A GENERIC READOUT CIRCUIT FOR INFRARED FOCAL PLANE ARRAYS (IRFPAS) THAT MAY BE USED WITH ANY INFRARED (IR) DETECTOR, OF ANY SIZE AND ARRAY

CONFIGURATION, BY ELIMINATION OF THE INDIUM BUMP BONDS USING A NON-CONTACT ELECTRICAL INTERCONNECT. THE CONCEPT IS THE SOLID STATE EQUIVALENT OF A VIDICOM TUBE USING ELECTRON BEAMS GENERATED BY VACUUM MICROELECTRONICS DEVICES (VMDS) TO "READ" THE IR GENERATED SIGNALS ON PHOTOVOLTAIC, PHOTOCONDUCTIVE, SCHOTTKY BARRIER, OR PYROELECTRIC DETECTORS. THE OBJECTIVE OF PHASE I IS TO ANALYZE THE FEASIBILITY OF THE VMD INTERCONNECT CONCEPT TO PRODUCE A GENERIC READOUT THAT WILL MEET THE VARIED IRFPA REQUIREMENTS WITHIN A TACTICAL MISSION AREA. THE THEORY OF VMD OPERATION WILL BE STUDIED, MODELED, AND USED IN CIRCUIT SIMULATIONS WITH A GENERIC FPA READOUT UNIT CELL. A BREADBOARD UNIT CELL WITH GENERIC DRIVE CIRCUITRY WILL BE DESIGN, BUILT, AND INTEGRATED WITH A VMD SAMPLE TO DEMONSTRATE THE CONCEPT. BASED ON THESE ANALYSES AND TEST RESULTS, A DETAILED WORK PLAN FOR A PHASE II GENERIC IRFPA IMAGING DEMONSTRATION WILL BE DEVELOPED. DEVELOPMENT OF A GENERIC IRFPA READOUT WILL ALLOW LARGE SCALE PRODUCTION OF IRFPAS WITH INCREASED YIELD AND RELIABILITY. IN ADDITION TO THE OBVIOUS COST REDUCTION BENEFIT TO DOD, THE RESULTING PROLIFERATION OF IR SYSTEMS WILL BENEFIT OTHER GOVERNMENT AND COMMERCIAL AGENCIES FOR APPLICATIONS SUCH AS BORDER SURVEILLANCE, FIREFIGHTING, POLLUTION MONITORING, LONG DURATION SPACE MISSIONS, INDUSTRIAL PRODUCTION AND QUALITY CONTROL, SAFETY INSPECTION, ENERGY MANAGEMENT, AND VISION ENHANCEMENT IN AUTOMOBILES AND AIRCRAFT.

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Contract #: DAAH0192CR055
PI: B. KUMAR
Title: AUTOMATION OF DOMAIN MODEL FOR SOFTWARE REUSE
Abstract: DOMAIN ANALYSIS (DA) IS THE FIRST STEP IN SOFTWARE REUSE AS IT PROPOSES A SYSTEMATIC, FORMAL AND EFFECTIVE PRACTICE OF SOFTWARE REUSE. UNFORTUNATELY, THE STATE OF THE INDUSTRY IS AT ITS INFANCY STAGE IN DA AND KNOWLEDGE BASE IS NOT READILY AVAILABLE. OUR EXPERIENCE INDICATES HOWEVER, THAT ACQUIRING AND STRUCTURING THE KNOWLEDGE IS THE BOTTLENECK OF DA. DR. RUBEN PRIETO-DIAZ HAS PROPOSED A FORMAL DA PROCESS TO CONVERT THE AD-HOC NATURE OF DA INTO A REPEATABLE PROCEDURE. WE WILL IMPLEMENT THIS METHODOLOGY IN ONE APPLICATION DOMAIN. WE PROPOSE TO ASSESS THE POTENTIAL FOR AUTOMATION OF DA AND TEST ITS APPLICABILITY TO AN APPLICATION DOMAIN. EXISTING TECHNIQUES AND TOOLS, IN PARTICULAR THOSE FROM INFORMATION RETRIEVAL AND EXPERT SYSTEMS DEVELOPMENT, PROVIDE SUPPORT FOR ACTIVITIES IN THE DA PROCESS. MANY OF THESE TOOLS CAN BE USED IMMEDIATELY, WHILE CERTAIN DA ACTIVITIES WILL REQUIRE THE CREATION OF NEW TOOLS. THERE IS A DEFINITE POTENTIAL FOR AUTOMATING PARTS OF DA PROVIDED THAT A BASIC FRAMEWORK TO CONDUCT DA EXITS. STARS REUSE LIBRARY PROCESS MODEL WILL BE USED FOR AUTOMATING THE PRIMITIVE OPERATIONS. THE OBJECTIVE IN PHASE I IS DEVELOP AN AUTOMATION OF DOMAIN MODEL FOR REUSE ENVIRONMENT, ADMSR. OUR RESULTS WILL SUPPORT COMMAND AND CONTROL, MANAGEMENT INFORMATION SYSTEMS, AND FLIGHT SIMULATION DOMAINS. WE WILL PROVIDE THE FRAMEWORK FOR STANDARDIZING SOME OF THE ACTIVITIES OF DA, SPECIFICALLY DOMAIN MODEL FOR AN APPLICATION DOMAIN. COMMERCIAL APPLICATIONS INCLUDE TAILORING OF ADMSR TO SUPPORT SPECIFIC DOMAINS, MANAGEMENT INFORMATION SYSTEMS AND FLIGHT SIMULATION, FOR EXAMPLE.

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Phone: (407) 984-3370
Topic#: 91-212 ID#: 9120460
Office: SSTO
Contract #: DAAH0192CR073
PI: EDWARD COMER
Title: SAHIB: THESAUROFACETED REUSE TOOLS SUPPORTING THE RAPID ACQUISITION AND EXPLOITATION OF DOMAIN KNOWLEDGE
Abstract: THIS PROPOSAL PRESENTS THE CONCEPT FOR A SUITE OF REUSE TOOLS SUPPORTING THE RAPID ACQUISITION AND EXPLOITATION OF DOMAIN KNOWLEDGE TO SUPPORT DOMAIN-DIRECTED REUSE. THE

PROPOSED TOOLSET IS NAMED SAHIB, IN HONOR OF RAO SAHIB S.R. RANGANATHAN, THE RECOGNIZED FATHER OF LIBRARY SCIENCE AND INFORMATION RETRIEVAL. THE APPROACH IS BASED UPON AN INNOVATIVE REPOSITORY TECHNOLOGY, TERMED THESAUROFACETS, FOR DOMAIN KNOWLEDGE REPRESENTATION. THESAUROFACETS ARE AN INTEGRATION OF FACETED CLASSIFICATIONS WITH A THESAURUS. THE SAHIB KNOWLEDGE BASE WILL BE INITIALLY POPULATED FROM EXISTING GOVERNMENT THESAURI TO PROVIDE BROAD, APPLICATION DOMAIN KNOWLEDGE OF MILITARY SYSTEMS. SAHIB WILL EMPLOY AN ADVANCED COOPERATING TOOL ARCHITECTURE THAT WILL SEAMLESSLY INTEGRATE THE THESAUROFACETED REUSE TOOLS WITH THE STARS ASSET MANAGEMENT SYSTEM. THE FEASIBILITY OF THE APPROACH WILL BE DEMONSTRATED IN PHASE I AND AN INITIAL OPERATIONAL SAHIB TOOLSET WILL BE AVAILABLE, FULLY POPULATED WITH DOMAIN KNOWLEDGE, AT THE END OF PHASE II. REUSE-IN-THE-LARGE, ACHIEVED THROUGH DOMAIN-DIRECTED REUSE, WILL REDUCE SOFTWARE DEVELOPMENT COSTS AND SCHEDULES AND LEAD TO INCREASED RELIABILITY, MAINTAINABILITY AND INTEROPERABILITY. WITH YEARLY SOFTWARE EXPENDITURES IN THE DOD ALONE EXCEEDING 20 BILLION IN THE 1990'S, THERE IS WIDE-SPREAD APPLICABILITY OF THE TECHNOLOGY. THE COMMERCIAL SECTOR SUFFERS FROM THE SAME "SOFTWARE CRISIS". THUS, IT HAS A COMMERCIAL POTENTIAL OF EVEN GREATER SIZE.

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Topic#: 91-025
Office:
Contract #: DAAH0191CR178
PI: ALAN STANTON

ID#: 9110119

Title: PLASMA PROCESS CONTROL USING MULTIPLE OPTICAL SENSORS

Abstract: THE DEVELOPMENT OF REAL-TIME PROCESS CONTROL FOR SEMICONDUCTOR DEVICE FABRICATION IS CRITICAL TO ADVANCING THE TECHNOLOGY IN MANUFACTURING MICROELECTRONIC CIRCUITS. IN PHASE I, RECENT ADVANCES IN TUNABLE DIODE LASER FABRICATION AND DETECTION TECHNOLOGY WILL BE EXPLOITED TO DEVELOP COMPACT AND COST EFFECTIVE INSTRUMENTATION FOR PLASMA PROCESS MONITORING AND CONTROL. PHASE I WILL FOCUS ON FLUORO-CARBON-BASED PLASMAS SUCH AS THOSE USED IN THE ETCHING OF SILICON, OXIDES, CERTAIN METALS, AND SILICIDES. IN SITU MEASUREMENTS WILL BE PERFORMED IN A REFERENCE CELL PLASMA RECTOR WHICH IS INSTRUMENTED WITH ACCD CAMERA SYSTEM FOR OPTICAL EMISSION SPECTROSCOPY. THE PROTOYPE DIODE LASER SENSOR WILL BE USED TO COMPLEMENT THE EMISSION MEASUREMENTS IN MEASURING ADDITIONAL PLASMA PROPERTIES, INCLUDING THE CONCENTRATIONS OF NEUTRAL RADICALS, FEED GAS DISSOCIATION FRACTIONS, AND THE CONCENTRATIONS OF GAS PHASE ETCH PRODUCT SPECIES. A CHEMOMETRIC-BASED APPROACH WILL BE USED TO DEFINE CORRELATIONS BETWEEN PARAMETERS MEASURED WITH THE LASER AND EMISSION SENSORS AND MACROSCOPIC RESULTS OF THE PLASMA ETCH PROCESS. THE RESULTS OF PHASE I WILL PROVIDE AS BASIS FOR DETAILED EXPERIMENTAL EVALUATIONS OF PLASMA PROCESS CONTROL SCHEMES USING DIODE LASER INSTRUMENTATION COMBINED WITH OPTICAL EMISSION SPECTROSCOPY IN PHASE II. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE PROPOSED INSTRUMENTATION HAS VERY STRONG POTENTIAL FOR COMMERCIAL APPLICATIONS IN MONITORING OR CONTROL OF MICROELECTONIC DEVICE FABRICATION PROCESSES. THE TECHNIQUES AND INSTRUMENTATION COULD POTENTIALLY BE APPLIED TO A WIDE VARIETY OF PLASMA PROCESSES, INCLUDING EITHER ETCHING OR DEPOSITION PROCESSES, AND A WIDE RANGE OF MATERIALS, INCLUDING SEMICONDUCTORS, INSULATORS, METALS, ETC.

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Topic#: 91-206
Office: ESTO
Contract #: DAAH0192CR074
PI: C. TIMOC

ID#: 9120244

Title: A 250 MHZ, CMOS, STANDARD CELL LIBRARY FOR THE IMPLEMENTATION OF PIPELINED SYSTEMS WITH LOW POWER DISSIPATION

Abstract: THE OBJECTIVE OF THE PHASE I ADVANCED DEVELOPMENT EFFORT ARE TO DESIGN A HIGH-SPEED,

LOW-POWER, STANDARD CELL LIBRARY WHICH IS ANTICIPATED TO PROVIDE A FACTOR OF 3 INCREASE IN THE PERFORMANCE-TO-POWER RATIO OF CMOS DIGITAL INTEGRATED CIRCUITS. A NOVEL CMOS CIRCUIT, CALLED PDL (PIPELINED DIFFERENTIAL LOGIC), WAS DEVELOPED AND SEVERAL DESIGNS WERE FABRICATED FOR THE PAST 3 YEARS. ALTHOUGH, PDL INTEGRATED CIRCUITS OPERATED AT 1 GHZ, UNFORTUNATELY, THAT WAS ACCOMPLISHED WITH A 5 V POWER SUPPLY AND CONSEQUENTLY AT THE EXPENSE OF HIGH POWER DISSIPATION. THE INNOVATIVENESS OF THE PROPOSED RESEARCH IS BASED ON THE RECOGNITION THAT A STANDARD CELL LIBRARY EMPLOYING THE PDL CIRCUITS CAN BE DEVELOPED TO OPERATE WITH A CLOCK FREQUENCY OF 250 MHZ AND ONLY A 2 V POWER SUPPLY. BECAUSE AT HIGH FREQUENCY MOST OF THE POWER DISSIPATED IS DYNAMIC, A REDUCTION OF THE POWER SUPPLY VOLTAGE FROM 5 V TO ONLY 2 V WILL REDUCE THE DYNAMIC POWER DISSIPATION BY A FACTOR OF 9. A PIPELINED FLOATING POINT ADDER WILL SERVE AS A TEST VEHICLE TO DETERMINE BY SIMULATION (PHASE I) AND TO VALIDATE EXPERIMENTALLY (PHASE II) THAT A 250 MFLOP THROUGHPUT AND LESS THAN 3 W POWER DISSIPATION CAN BE ACHIEVED WITH A COMBINATION OF PDL CIRCUITS, 2 V POWER SUPPLY, AND 0.8 μM CMOS FABRICATION PROCESS. A SUCCESSFUL COMPLETION OF THE PROPOSED ADVANCED DEVELOPMENT WILL ENABLE US TO DEVELOP AND MARKET SEVERAL PIPELINED VLSI CHIPS SUCH AS FLOATING-POINT UNITS, DIGITAL FILTERS, AND DIGITAL CORRELATORS WITH A SIGNIFICANTLY HIGHER PERFORMANCE-TO-COST RATIO THAN THAT OF EXISTING PRODUCTS.

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Topic#: 91-006 ID#: 9110455
Office:
Contract #: DAAH0191CR192
PI: BARRY CHARLES

Title: COVERT LOCATION AND IDENTIFICATION COMMUNICATOR (CLIC)

Abstract: THIS PROPOSAL PRESENTS A PLAN FOR DEVELOPING A LOW-COST, HAND-HELD COVERT LOCATION AND IDENTIFICATION COMMUNICATOR (CLIC) TO ENHANCE THE SURVIVABILITY OF LIGHT INFANTRY ARTILLERY SPOTTERS,PATROLS, AND SPECIAL OPERATIONS UNITS. THIS DEVICE WILL INCREASE THE SURVIVABILITY OF COMBAT UNITS OPERATING AHEAD OF FRIENDLY LINES BY PROVIDING TO THEM THE ABILITY TO TRANSMIT THEIR CODED IDENTIFICATION AND LOCATION, AND THE LOCATION AND TYPES OF ENEMY FORCES DISCOVERED. IT USES A TECHNIQUE THAT IS UNDETECTABLE BY AN ENEMY EQUIPPED WITH CONVENTIONAL ELECTRONIC SIGNAL INTERCEPT AND LOCATING EQUIPMENT. CLIC COMMUNICATES USING INVISIBLE ULTRA VIOLET (UV) LIGHT, MODULATED (PULSE POSITION MODULATION) IN VERY SHORT PULSES FORMING AN ENCRYPTED DIGITAL MESSAGE CONTAINING THE NECESSARY INFORMATION. THE PROPERTIES OF UV PROPAGATION THROUGH THE ATMOSPHERE ARE SUCH THAT SIGNALS ARE DETECTABLE AT REASONABLE RANGES (UP TO A FEW KILOMETERS) WHEN THE TRANSMITTER IS APPROXIMATELY POINTED AT THE RECEIVER (DIRECT LINE-OF-SIGHT IS NOT REQUIRED). HOWEVER, THE UV SIGNALS ARE DETECTABLE AT ONLY A SHORT DISTANCE WHEN THE RECEIVER IS LOCATED TO THE SIDE OF, OR BEHIND THE TRANSMITTER. REMAINING COVERT WHILE TRANSMITTING NECESSARY INFORMATION TO FRIENDLY FORCES, AND PROPERLY IDENTIFYING THEMSELVES AND THEIR POSITION TO AVOID MISTAKEN ATTACK BY FRIENDLY FORCES, IS NECESSARY FOR THE SURVIVAL OF UNITS OPERATING AHEAD OF FRIENDLY LINES. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE PROPOSED CLIC SYSTEM ENHANCES BOTH THE SURVIVABILITY AND THE EFFECTIVENESS OF INFANTRY SOLDIERS OPERATING AHEAD OF FRIENDLY LINES BY PROVIDING REAL-TIME COVERT COMMUNICATIONS ABILITY. IT IS UNDETECTABLE BY EXISTING FIELDED LASER LOCATION EQUIPMENT, AND IS AUDIBALLY SILENT. IT IS INEXPENSIVE, AND HAS POTENTIAL COMMERCIAL APPLICATION TO LAW ENFORCEMENT AND THE "WAR ON DRUGS."

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Topic#: 91-013 ID#: 9110498
Office:
Contract #: DAAH0191CR164
PI: JOHN WHITE

Title: ADVANCED MATERIALS FOR ANTI-ARMOR APPLICATIONS

Abstract: IMPROVEMENTS IN ADVANCED TANK ARMOR NECESSITATES KINETIC ENERGY PROJECTILES WITH GREATER PENETRATION CAPABILITY. PENETRATION CAPABILITY IS DIRECTLY RELATED TO KINETIC ENERGY (KE) ON TARGET. ONE WAY TO INCREASE THE KE ON TARGET FOR A GIVEN GUN SYSTEM IS TO LOWER THE PARASITIC MASS. THIS CAN BE ACCOMPLISHED BY REPLACING EXISTING METAL DESIGNS WITH HIGHER SPECIFIC STRENGTH AND STIFFNESS COMPOSITE MATERIALS. CURRENT COMPOSITE SABOT FABRICATION TECHNIQUES INVOLVES LAYING UP COMPOSITE LAMINATED PANELS WHICH ARE CUT INTO WEDGE SECTIONS AND BONDED TOGETHER TO FORM A BILLET WHICH IS MACHINED INTO THE FINAL SHAPE. THIS RESULTS IN MISALIGNED FIBERS FROM THE PANEL LAYUP BEING CUT TO WEDGE SHAPES AND CAN CAUSE INCREASED COSTS, POOR CONSISTENCY, AND POTENTIAL FOR A WEAK PART DUE TO POOR BONDING. TO IMPROVE UPON THE CURRENT COMPOSITE AEROSHELL/SABOT DESIGN/FABRICATION, IT IS MANDATORY TO INTEGRATE THE ANALYTICAL AND FABRICATION DESIGN EFFORT. TO FULLY REALIZE THE INHERENT ADVANTAGES OF COMPOSITES, IT IS NECESSARY TO DESIGN THE PART ACCOUNTING FOR DIRECTIONAL PROPERTIES AND SPECIFIC FABRICATION CONSIDERATIONS. THE PROPOSED PROGRAM INVESTIGATES AN INNOVATIVE ALTERNATIVE TO THE CURRENT FABRICATION TECHNIQUE. THIS APPROACH IS DIRECTLY TIED TO THE ANALYSIS AND REQUIRES FEWER BONDED PARTS WITHOUT FIBER MISALIGNMENT BY USING SPECIALIZED NET COMPRESSION MOLDING. THE RESULT IS A CONSISTENT, RELIABLE AND COST EFFECTIVE FABRICATED PART REQUIRING MINIMUM SECONDARY MACHINING. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE U.S. ARMY, NAVY/MARINE CORPS AND THEIR AFFILIATED RESERVE UNITS WILL HAVE REQUIREMENTS FOR SABOTED ROUNDS.

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Topic#: 91-048 ID#: 9110489
Office:
Contract #: DAAH0191CR259
PI: GARY FALACARA

Title: RESEARCH AND DEVELOPMENT OF AN EXTENSIBLE, TAILORABLE SOFTWARE DEVELOPMENT PROCESS AND PRODUCT....

Abstract: SOFTWARE DEVELOPMENT IS A COMPLEX AND PROLIFIC PHENOMENA IN WHICH A VARIETY OF INTERRELATED PROCESSES ARE INVOLVED AND A MYRIAD OF PRODUCTS ARE CREATED. FOR DEVELOPMENT TO OCCUR SMOOTHLY AND EFFICIENTLY, THE PROCESSES AND PRODUCTS MUST BE METICULOUSLY PLANNED AND DOCUMENTED. IN THE WORLD OF GOVERNMENT SPONSORED SOFTWARE DEVELOPMENT, A NUMBER OF STANDARDS EXIST TO INSURE JUST SUCH PLANNING AND DOCUMENTATION. THE FLEXIBILITY PROVIDED BY THESE STANDARDS, HOWEVER, TRANSFERS THE BURDEN OF INSTRUMENTATION ONTO THE DEVELOPER WHO IS FACED WITH A GREAT MANY REPRESENTATION AND PRODUCTION INCOMPATIBILITIES AND PROBLEMS. TO ADDRESS THIS PROBLEM, AN EFFORT TO DEVELOP AN EXTENSIBLE SOFTWARE DEVELOPMENT PROCESS AND PRODUCT REPRESENTATION AND A COMPLEMENTARY DOCUMENTATION AND SUPPORT ENVIRONMENT AROUND THIS PRESENTATION IS PROPOSED. THIS EFFORT WILL FORMALIZE THE REPRESENTATION BY UTILIZING TECHNIQUE OF SEMANTIC MODELING. THE SUPPORT ENVIRONMENT WILL BE ELABORATED BY IDENTIFYING THE TOOLS AND TYPES OF SUPPLEMENTAL INFORMATION NEEDED TO MAKE PLANNING AND DOCUMENTATION PRACTICAL. THE PROPOSED EFFORT HAS BEEN STRUCTURED TO INCORPORATE TECHNOLOGIES ALREADY BEING UTILIZED ON DARPA TECHNOLOGY PROGRAMS SUCH AS STARS AND ARCADIA AS WELL AS COMMERCIAL STANDARDS. LONG TERM PLANS CALL FOR THE COMMERCIALIZATION OF THIS TECHNOLOGY AS A SUPPORT TECHNOLOGY FOR SOFTWARE ENGINEERING ENVIRONMENTS. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS- THE TECHNOLOGY IS EXPECTED TO HAVE A BROAD RANGE OF APPLICATIONS IN BOTH GOVERNMENT AND COMMERCIAL MARKETS. THE TECHNOLOGY WILL BE PARTICULARLY USEFUL IN SUPPORTING STANDARDIZED TOOLS FOR CAPTURING AND DOCUMENTING INFORMATION ABOUT SOFTWARE DEVELOPMENT EFFORTS.

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Topic#: 91-001 ID#: 9110344
Office:
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Phone: (513) 435-4184 PI: PAUL ZIDEK
Title: LOW RCS TARGET DETECTION AND TRACKING SENSOR
Abstract: THE OBJECT OF THIS PHASE I ACTIVITY WILL BE TO IDENTIFY THOSE ROBUST SIGNATURE CHARACTERISTICS WHICH ARE DIFFICULT TO SUPPRESS THAT MAY BE PRESENT IN A NUMBER OF ADVERSARIAL RESOURCES. A QUALITATIVE ASSESSMENT OF THEIR RELATIVE VALUE AND THE INFORMATION THAT THEY PROVIDE WILL BE DETERMINED AND RANKED TO IDENTIFY THOSE FACTORS WHICH CAN LEAD TO A ROBUST SENSOR DESIGN. THE APPROACH WILL EMPLOY AN N-DIMENSIONAL ANALYSIS OF THESE VARIOUS INPUTS TO DETERMINE THE ALGORITHMS THAT CAN BE BEST USED FOR COMBINING THESE CHARACTERISTICS AND IDENTIFYING POSSIBLE REACTION MODES. FROM THIS ANALYSIS A BREADBOARD SENSOR DESIGN WILL BE CONFIGURED. THIS ACTIVITY IS A KEY INITIATIVE IN FUTURE DEVELOPMENTS FOR STEALTHY BATTLEFIELD OPERATION AS NUMEROUS US CAPABILITIES ARE UNDOUBTEDLY BEING DEVELOPED. SENSOR DEVELOPMENTS FOR PHASE II ARE ANTICIPATED TO UTILIZE OFF-THE-SHELF EQUIPMENT TO DEVELOP A BREADBOARD TO INVESTIGATE SPECIFIC TARGET SIGNATURE CHARACTERISTICS WHICH MAY BE EXPLOITED BY THE SENSOR DESIGN. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THIS ACTIVITY IS A KEY INITIATIVE IN FUTURE DEVELOPMENTS FOR STEALTHY BATTLEFIELD OPERATION AS NUMEROUS US CAPABILITIES ARE UNDOUBTEDLY BEING DEVELOPED. SENSOR DEVELOPMENTS FOR PHASE II ARE ANTICIPATED TO UTILIZE OFF-THE-SHELF EQUIPMENT TO DEVELOP A BREADBOARD TO INVESTIGATE SPECIFIC TARGET SIGNATURE CHARACTERISTICS WHICH MAY BE EXPLOITED BY THE SENSOR DESIGN.

SPECTRUM PHOTONICS Topic#: 91-063 ID#: 9110001
6034 W. COURTYARD DRIVE, #305, P.O. BOX 162004 Office:
AUSTIN, TX 78716 Contract #: DAAH0191CR200
Phone: (818) 795-1163 PI: PAUL WEST
Title: "DEVELOPMENT OF A *MULTIPLE WAVELENGTH LASER DIODE (MWLD) IN THE 1.1 TO 1.6 MICRON* RANGE"
Abstract: THE OBJECTIVE IS TO DEVELOP A MULTIPLE WAVELENGTH LASER DIODE BASED ON QUANTUM WELL TECHNOLOGY. THE DEVICE IS BASED ON GALLIUM INDIUM ARSENIC PHOSPHIDE ON AN INDIUM PHOSPHIDE SUBSTRATE. THE MATERIAL COMPOSITION IS TO BE DETERMINED ACCORDING TO THE FORMULA OF 1-X AND 1-Y FOR ALL VALUES OF X AND Y LESS THAN 1.0. THE OBJECTIVE IS TO IDENTIFY MATERIALS WHICH WILL PRODUCE SPECIFIC OUTPUT WAVELENGTHS BETWEEN 1.1 AND 1.6 MICRONS. A DEVICE GEOMETRY WILL BE DEVELOPED USING MULTIPLE QUANTUM WELLS WHICH WILL PROVIDE A SPECIFIC OUTPUT WAVELENGTH CORRESPONDING TO A SPECIFIC ELECTRICAL SIGNAL INPUT. IN PHASE I THE MATERIALS WILL BE SPECIFIED, THE DEVICE GEOMETRY AND ARCHITECTURE DEVELOPED, AND A MANUFACTURING TECHNOLOGY/METHODOLOGY ESTABLISHED. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE BENEFIT IS SIGNIFICANTLY INCREASED DATA RATES AND INCREASED CAPACITY OF EACH OPTICAL FIBER PAIR. THE COMMERCIAL APPLICATIONS ARE IN HIGH SPEED TELECOMMUNICATIONS AND DATA COMMUNICATIONS APPLICATIONS.

SPIRE CORP. Topic#: 91-060 ID#: 9110041
ONE PATRIOTS PARK Office:
BEDFORD, MA 01730 Contract #: DAAH0191CR252
Phone: (617) 275-6000 PI: STANLEY VERNON
Title: GAAS VERTICAL SUPERLATTICES FOR MONOLITHICALLY INTEGRATABLE LWIR DETECTOR ARRAYS
Abstract: ONE PROMISING APPROACH TO THE FABRICATION OF LONG-WAVELENGTH INFRARED (LWIR) DETECTORS IS THE USE OF GAAG-A1GAAS MULTIPLE-QUANTUM-WELL (MQW) STRUCTURES, ALTHOUGH A MAJOR DIFFICULTY IS CAUSED BY THE FACT THAT, TO BE DETECTED, THE RADIATION MUST BE PARALLEL TO THE HETEROINTERFACES. THIS IS THE PROBLEM ADDRESSED. WE PROPOSE THE DEVELOPMENT OF A TECHNOLOGY TO ACCOMPLISH ATOMIC-SCALE GROWTH OF NEARLY VERTICAL SUPERLATTICE (NVSL) STRUCTURES CONTAINING GAAS MULTIPLE QUANTUM WELLS WITH INTERFACE PLANES PERPENDICULAR TO THE GAAS WAFER SURFACE. THIS WILL PERMIT THE FABRICATION OF LWIR GAAS-A1GAAS MQW

DETECTORS WHICH FUNCTION WITH IR RADIATION THAT IS NORMAL TO THE WAFER SURFACE, ALLOWING FOR THE EASY FABRICATION OF MANY-ELEMENT DETECTOR ARRAYS AND MONOLITHIC INTEGRATION OF DETECTORS WITH OTHER GAAS-BASED SIGNAL PROCESSING COMPONENTS. OUR BASIC APPROACH IS TO USE THE REGULARLY SPACED ATOMIC STEPS ON A GAAS SUBSTRATE SURFACE ORIENTED A FEW DEGREES OFF THE (100) AXIS TO NUCLEATE AND CONTROL THE GROWTH OF NEARLY VERTICAL SUPERLATTICES; DEPOSITION WILL BE BY LOW-PRESSURE METALORGANIC CHEMICAL VAPOR DEPOSITION (MOCVD). PHASE I WILL ESTABLISH THE MOCVD TECHNOLOGY NEEDED TO PRODUCE NVSL STRUCTURES USING GAAS AND ALAS REGIONS, WILL CHARACTERIZE THE PROPERTIES OF SUCH STRUCTURES, AND WILL ATTEMPT TO DEMONSTRATE A SIMPLE NVSL LWIR PHOTOCONDUCTIVE DETECTOR. PHASE II WILL SEEK TO OPTIMIZE CONTROL OF THE GROWTH AND DOPING OF NVSL REGIONS, TO DEVELOP A METHOD FOR OPTICAL CONFINEMENT, TO FABRICATE AND TEST LWIR DETECTORS AND ARRAYS, AND TO MONOLITHICALLY INTEGRATE DETECTORS WITH OTHER CIRCUIT ELEMENTS.

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Topic#: 91-062 ID#: 9110449
Office:
Contract #: DAAH0191CR180
PI: JOONGWOO AHN

Title: AN ORGANIC MOLECULAR SYSTEM FOR NONLINEAR OPTICS

Abstract: APPLICATIONS OF NONLINEAR OPTICAL (NLO) MATERIALS TO TECHNOLOGIES SUCH AS OPTICAL SIGNAL PROCESSING, SWITCHING AND COMPUTING SYSTEMS, HAS BEEN INTENSIVELY STUDIED DURING THE LAST DECADE. STILL, THE LACK OF NLO MATERIALS WITH ENHANCED SECOND AND THIRD ORDER SUSCEPTIBILITY LIMITS DEVELOPMENT OF THESE APPLICATIONS. ORGANIC NLO MATERIALS ARE OFTEN CITED AS HAVING THE BEST LONG-RANGE PROMISE FOR NLO DEVICES, SINCE THEY HAVE BEEN EXPERIMENTALLY PROVEN TO OUTPERFORM INORGANIC MATERIALS IN SEVERAL ASPECTS: LARGER NONLINEARITIES, FASTER RESPONSE TIME, AND BETTER COMPATIBILITY WITH OTHER LINEAR OPTICAL MATERIALS. SPIRE PROPOSES TO DEVELOP A NEW FAMILY OF ORGANIC/POLYMERIC NLOMATERIALS WITH LARGER OPTICAL NONLINEARITIES THAN ARE CURRENTLY AVAILABLE. THE NONLINEAR PROPERTIES OF THE MATERIALS WILL BE IMPROVED BY INCREASING THE DIPOLE MOMENTS OF THE OPTICALLY ACTIVE MOLECULES. THE NEW MATERIALS, BASED ON 2-METHYL-4-NITROANILINE (MNA), WILL BE SYNTHESIZED BY APPROPRIATELY SUBSTITUTING ELECTRON-DONOR AND ELECTRON-ACCEPTOR GROUPS INTO TWO BENZENE RINGS AND LINKING THE BENZENE BY AZOMETHINE BRIDGING. THE AVAILABILITY OF SEVERAL PROMISING ELECTRON-DONORS AND ELECTRON-ACCEPTORS WILL LEAD TO THE SYNTHESIS OF A VARIETY OF NEW NLO MATERIALS. SUCCESSFUL PHASE I DEMONSTRATION OF THE NEW MATERIALS WILL LEAD TO A PHASE II PROGRAM IN WHICH REAL DEVICE TYPES, SUCH AS NLO FIBERS AND OPTICAL MODULATORS, WILL BE BUILT AND EVALUATED.

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Topic#: 91-081 ID#: 9110443
Office:
Contract #: DAAH0191CR253
PI: NASSER KARAM

Title: ATOMIC LAYER EPITAXY OF III-V COMPOUNDS FOR REPRODUCIBLE MULTILAYER NANOSTRUCTURES

Abstract: THE PROPOSED RESEARCH PROGRAM WILL COUPLE ATOMICLAYER EPITAXY (ALE) WITH CONVENTIONAL METALORGANIC CHEMICAL VAPOR DEPOSITION (MOCVD) MULTILAYERED DEVICE STRUCTURES WITH ULTRA-THIN (20-2500 A) FEATURES. THE BENEFIT OF THIS WILL BE HIGHER THROUGHPUT, YIELD AND REPRODUCIBILITY THAN CAN BE OBTAINED BY ALE ALONE. ALE IS ESPECIALLY SUITED FOR THE DEPOSITION OF ULTRA-THIN FILMS, OFFERING EXCELLENT UNIFORMITY AND THICKNESS CONTROL IN A SELF-LIMITING MANNER. A HYBRID DEPOSITION SCHEME WHICH COMBINES ALE AND CONVENTIONAL MOCVD DEPOSITION WILL BE UTILIZED TO GROW QUANTUM WELL (QW) LASER STRUCTURES IN THE A1GAAS/GAAS SYSTEM. THE GOAL OF PHASE I WILL BE TO ESTABLISH DEPOSITION PARAMETERS FOR ALE OF GAAS/A1GAAS IN A LARGE-SCALE, MULTIPLE WAFER MOCVD SYSTEM. A SECOND OBJECTIVE WILL BE TO DEMONSTRATE FEASIBILITY OF THE HYBRID DEPOSITION SCHEME, WHERE

THE ACTIVE GAAS-A1GAAS INTERFACES OFA QW LASER WILL BE DEPOSITED BY ALE AND THE REST OF THE STRUCTURE BY CONVENTIONAL MOCVD. PHASE II WILL SEEK TO OPTIMIZE MO-ALE DEPOSITION PARAMETERS AND DEVICE STRUCTURES (QW LASER AND HBTS) FOR EXCELLENT UNIFORMITY, REPRODUCIBILITY AND LOWER COST. REACTOR DEVELOPMENT WILL BE INCLUDED AS PART OF THE MO-ALE OPTIMIZATION PROCESS FOR HIGHER YIELD WITHOUT COMPROMISING REACTOR THROUGHPUT. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE SUCCESSFUL COMPLETION OF PHASES I AND II WILL PROVIDE A RELIABLE PROCESS FOR GAAS/A1GAAS MULTILAYER STRUCTURES, SUCH AS QW LASERS AND HBTS, WITH EXCELLENT CONTROL OVER WELL THICKNESS, GOOD REPRODUCILITY, AND HIGH YIELD. MOREOVER, THESE RESEARCH EFFORTS WILL LEAD TO THE DEVELOPMENT OF A NEW GENERATION OF REACTORS CAPABLE OF LARGE AREA DEPOSITION WITH PRECISE CONTROL OVER FILM THICKNESS, AND COMPOSITION.

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Topic#: 91-097 ID#: 9121218
Office: DSO
Contract #: DAAH0192CR212
PI: PIRAN SIOSHANSI

Title: SIMPLIFIED DIAMOND POLISHING USING AN ION IMPLANTATION ASSISTED TECHNIQUE

Abstract: DIAMOND, BECAUSE OF ITS HARDNESS, CHEMICAL INERTNESS, AND OPTICAL (INFRARED) ABSORPTION PROPERTIES, IS AN EXCELLENT MATERIAL FOR PROTECTING INFRARED WINDOWS AND DOMES AGAINST ENVIRONMENTAL EFFECTS, SUCH AS RAIN AND DUST EROSION. CHEMICAL VAPOR DEPOSITION (CVD) AND RELATED PROCESSES HAVE BEEN DEVELOPED AS A MEANS OF APPLYING SYNTHETIC DIAMOND FILMS FOR THIS APPLICATION. HOWEVER, IN SPITE OF RECENT PROGRESS, CVD DIAMOND IS LESS THAN SATISFACTORY BECAUSE THE DEPOSITS ARE POLYCRYSTALLINE IN FORM WITH GRAINS OF VARYING SIZES AND ORIENTATIONS, CAUSING OPTICAL SCATTER. POLISHING OF DIAMOND FILMS WITH DIAMOND PARTICLES CAN BE USED TO REDUCE THIS SCATTER, BUT THE POLISHING PROCESS IS LONG AND EXPENSIVE, AND DOES NOT PRODUCE IDEAL RESULTS. FURTHERMORE, DURING MECHANICAL POLISHING, GRAINS IN THE FILM FREQUENTLY BECOME DISLODGED, EXTENDING THE NECESSARY POLISHING TIME. ION IMPLANTATION OF DIAMOND AND POLYCRYSTALLINE DIAMOND CREATES SUBSTANTIAL RADIATION DAMAGE, AMORPHIZATION, AND ULTIMATELY GRAPHITIZATION. THE ION BOMBARDED LAYERS CREATED ON DIAMOND SUBSTRATES ARE SUBSTANTIALLY SOFTER THAN THE BULK MATERIAL, AND ARE THEREFORE MUCH EASIER TO POLISH. SPIRE PROPOSES TO PERFORM A PROOF-OF-PRINCIPLE STUDY, DEMONSTRATING A PROCESS FOR POLISHING POLYCRYSTALLINE DIAMOND WHICH CONSISTS OF ION IMPLANTATION FOLLOWED BY MECHANICAL POLISHING. OPTICAL QUALITY FINISHES SIGNIFICANTLY BETTER THAN THOSE WHICH CAN BE OBTAINED FROM MECHANICAL POLISHING ALONE ARE PRODUCED BY SUCH SEQUENTIAL IMPLANTATION AND POLISHING; IT IS ANTICIPATED THAT THIS PROCESS WILL SIGNIFICANTLY SIMPLIFY THE POLISHING OF POLYCRYSTALLINE DIAMOND. THE TECHNOLOGY WILL BE APPLICABLE TO FLAT GEOMETRIES AS WELL AS DOME SHAPED SURFACES. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - A METHOD TO POLISH POLYCRYSTALLINE DIAMOND EASILY AND ECONOMICALLY WOULD HAVE IMMEDIATE COMMERCIAL APPLICATIONS FOR REDUCING SCATTER IN DIAMOND-COATED IR OPTICAL COMPONENTS. THE PROCESS COULD ALSO BE APPLIED IN OTHER AREAS, SUCH AS ELECTRONIC PACKAGING MEDIA FOR HEAT TRANSFER, WHERE POLISHING OF DIAMOND HEAT SINKS WOULD ENHANCE THE HEAT TRANSFER SURFACE.

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Topic#: 91-004 ID#: 9110150
Office:
Contract #: DAAH0191CR298
PI: WALTER PODNEY

Title: DEVELOPMENT OF A PIEZOMAGNETOMETER

Abstract: WE PROPOSE TO DEVELOP A MAGNETOMETER THAT USES MAGNETOSTRICTIVE AND PIEZOELECTRIC ELEMENTS TO ATTAIN A SENSITIVITY APPROACHING 1 PICOTESLA PER ROOT HERTZ IN A SMALL, LOW COST, LOW POWER INSTRUMENT OPERATING AT AMBIENT TEMPERATURE. SUCH SENSITIVITY NOW

REQUIRES EITHER A COSTLY, HIGH-POWER MAGNETOMETER (E.G., A FLUXGATE) OR A SUPERCONDUCTING QUANTUM INTERFERENCE DEVICE (SQUID) THAT NEEDS EXPENSIVE AND CUMBERSOME CRYOGENICS TO OPERATE. OUR CONCEPT FOR A PIEZOMAGNETOMETER (PM) USES AN ELECTROMETER CIRCUIT TO MEASURE POLARIZATION CHANGES INDUCED ON THE SURFACE OF A PIEZOELECTRIC CRYSTAL BOUND BY A MAGNETOSTRICTIVE FILM. IN PHASE I, WE TEST CANDIDATE PIEZOELECTRIC AND MAGNETOSTRICTIVE MATERIALS TO SELECT THOSE GIVING HIGH TEMPERATURE, DEVELOP A HIGH GAIN TRANSDUCER USING THE SELECTED MATERIALS, AND USE THE TRANSDUCER TOGETHER WITH A COMMERCIALLY AVAILABLE ELECTROMETER TO DEMONSTRATE FEASIBILITY OF THE CONCEPT AND TO CALIBRATE ITS PERFORMANCE. IT LEADS TO PHASE II DEVELOPMENT OF A SMALL, LOW POWER, INTEGRATED PROTOTYPE PM SUITABLE FOR FIELD DEPLOYMENT. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS OF THE RESEARCH OR DEVELOPMENT. THE PIEZOMAGNETOMETER CAN PROVIDE MORE SENSITIVITY THAN PRESENT ROOM TEMPERATURE MAGNETOMETERS (E.G., ALKALI VAPOR OR FLUXGATE SENSORS) AND MORE CONVENIENCE THAN CRYOGENIC (SQUID) SENSORS. THESE SMALL, LOW POWER UNITS CAN BE SCATTERED IN A COMBAT ZONE TO DETECT MOVEMENTS OF VEHICLES AND COMBATANTS. THEY CAN ALSO AUGMENT CAPABILITIES IN ANTISUBMARINE WARFARE, MINE DETECTION, AND MINE FUSING. COMMERCIAL USES INCLUDE MINERAL AND OIL EXPLORATION, LOCATING BURIED CABLES AND PIPELINES, NONDESTRUCTIVE TESTING, AS WELL AS BIOMAGNETIC AND MATERIALS RESEARCH.

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Topic#: 91-075 ID#: 9110376
Office:
Contract #: DAAH0191CR201
PI: WILFRED GOODSON

Title: DEVELOPMENT OF THEATER LEVEL COST EFFECTIVENESS MEASURES FOR ADVANCED MATERIALS AND STRUCTURES

Abstract: THE DEPARTMENT OF DEFENSE HAS NO ADEQUATE WAY OF CALCULATING THE COST EFFECTIVENESS OF ADVANCED MATERIALS OR STRUCTURES USED IN MODERN WEAPON SYSTEMS, WHERE THE EFFECTIVENESS IS DEFINED IN TERMS OF OUTCOMES ON THE BATTLEFIELD. STR STRONGLY BELIEVES THAT THE DEPARTMENT OF DEFENSE NEEDS TO BE ABLE TO DETERMINE THE COST EFFECTIVENESS IN TERMS OF BATTLEFIELD OUTCOMES AND, FURTHER, THAT THE CORRECT LEVEL FOR BATTLEFIELD OUTCOMES IS AT THE THEATER LEVEL. WITH THE CONCEPTUAL DEVELOPMENT OF GEN. GLENN A. KENT'S "STRATEGIES TO TASK" ANALYSIS FRAMEWORK, WITH THE DEVELOPMENT OF STR CORPORATION'S OME-III METHODOLOGY WHICH TREATS THE ABSOLUTELY DOMINANT "OPERATIONAL ART," AND WITH THE DEVELOPMENT OF STR'S FORCE PLANNING ANALYSIS FRAMEWORK, IT IS NOW POSSIBLE TO COMPUTE COST EFFECTIVENESS MEASURES FOR MATERIALS AND STRUCTURES WITHIN THE SAME FRAMEWORK THAT CALCULATES THE SAME MEASURES FOR OTHER WEAPON SYSTEMS AND COMPONENTS. FURTHER, THE FPAF ASSURES THAT BOTH SIDES OPTIMALLY USE THEIR FORCES TO MAXIMIZE THE VALUE OF THE WEAPON SYSTEMS AND CHARACTERISTICS OF THOSE SYSTEMS. STR WILL USE THE FPAF TO DEMONSTRATE, USING A SINGLE SCENARIO, A SELECTED SET OF COMPONENTS, AND A SAMPLE SET OF MATERIALS AND STRUCTURES, THAT BATTLEFIELD COST EFFECTIVENESS MEASURES CAN BE DEVELOPED FOR MATERIALS AND STRUCTURES. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS OF THE RESEARCH OR DEVELOPMENT. WHEN IMPLEMENTED, THE PRODUCTION SYSTEM WILL BE USEFUL TO ANYONE INVOLVED IN THE DESIGN, DEVELOPMENT, AND PROCUREMENT OF ADVANCED MATERIALS AND STRUCTURES.

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Topic#: 91-183 ID#: 9120324
Office: CSTO
Contract #: DAAH0192CR013
PI: BERNARD JELTEMA

Title: ELECTRONIC PUBLISHING

Abstract: TECHNOLOGICAL ADVANCES DEFINE NEW REQUIREMENTS ON THE U.S. WORKFORCE WHICH PLACE DEMANDS ON THE NATIONAL EDUCATION SYSTEM TO SIGNIFICANTLY IMPROVE AND ACCELERATE

EDUCATION IN SCIENCE AND MATH. THIS PROJECT WILL PROVIDE DEVELOPMENT OF INNOVATIVE QUALITY COURSEWARE AND EFFECTIVE COURSE DELIVERY SYSTEMS TO ADDRESS THESE DEMANDS. THE FUNDAMENTAL TECHNICAL OBJECTIVE OF THIS PROPOSAL IS TO BEGIN TO ESTABLISH AN ELEGANT ELECTRONIC PUBLISHING FORMAT (EPF) AS THE STANDARD INTERACTIVE MULTIMEDIA FORMAT IN THE EDUCATIONAL PUBLISHING INDUSTRY. THIS EPF IS A COMPREHENSIVE, FLEXIBLE, HOLISTIC, VIDEO-FRIVEN, GRAPHICS-COURSEWARE. IT IS EFFECTIVE IN INSTRUCTOR-CONTROLLED AND STUDENT-CONTROLLED LEARNING ENVIRONMENTS OVER A BROAD RANGE OF INTERACTIVITY LEVELS. IT CAN BE USED TO DELIVER COURSES IN VIRTUALLY ANY SUBJECT MATTER TO STUDENTS IN MILITARY, BUSINESS, SCHOOL, OR HOME SETTINGS. THE PHASE I PROJECT OBJECTIVES ARE TO: 1. DEMONSTRATE A SUBSET OF THE ELECTRONIC PUBLISHING FORMAT (EPF). 2. SPECIFY A DELIVERY SYSTEM, INCLUDING HARDWARE AND SOFTWARE. 3. DESIGN A CHEMISTRY OR OTHER SCIENCE OR MATH COURSE USING THE EPF. 4. PLAN FOR DISTRIBUTION OF THE FIRST COURSE DEVELOPED. 5. DESIGN A COURSE TO TEACH TEACHERS HOW TO USE EPF COURSEWARE. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - 1. IMPROVES THE EFFECTIVENESS OF TEACHERS IN TEACHING SCIENCE AND MATH 2. MOTIVATES EDUCATIONAL PUBLISHERS TO PRODUCE COST EFF INTERACTIVE MULTIMEDIA COURSEWARE 3. INSPIRES STUDENTS TO LEARN SCIENCE AND MATH THROUGH INNOVATIVE MULTIMEDIA COURSEWARE THAT THE TEACHER AND/OR THE STUDENT CONTROL 4. APPLIES TO MILITARY, BUSINESS, SCHOOL AND HOME.

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Topic#: 91-010 ID#: 9110658
Office:
Contract #: DAAH0191CR195
PI: JAMES DANAHER
Title: DISRUPTION OF ARMORED VEHICLE OPERATIONS
Abstract: 3S PROPOSES TO EXPLORE INNOVATIVE MEANS OF DISRUPTING THE TEMPO OF ARMORED VEHICLE OPERATIONS, COMMAND AND CONTROL, TARGET ACQUISITION AND LOGISTICS. THE TECHNIQUES PROPOSED BY 3S WILL REDUCE THE EFFECTIVENESS OF ARMORED VEHICLE FIREPOWER AND RENDER THEM VULNERABLE TO ATTACK. THE PROPOSED TECHNOLOGIES ALSO HAVE THE PROSPECT OF SUPPORTING ANTI-DRUG AND ANTI-TERRORIST OPERATIONS. THE PHASE I EFFORT WILL CONSIST OF DEVELOPING A DETAILED DEFINITION OF THE PROPOSED CONCEPTS FOLLOWED BY AN OPTIMIZED DESIGN AND PERFORMANCE ANALYSIS OF PROOF-OF-PRINCIPLE HARDWARE. CERTAIN SUBCOMPONENT PROTOTYPING AND DEVELOPMENT WILL ALSO BE PERFORMED DURING PHASE I. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS OF THE RESEARCH OR DEVELOPMENT. DEPLOYMENT OF THE PROPOSED TECHNOLOGIES WILL PROVIDE TACTICAL COMMANDERS WITH IMPORTANT BATTLEFIELD, ANTI-DRUG AND ANTI-TERRORIST DECEPTION ASSETS.

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Topic#: 91-016 ID#: 9110716
Office:
Contract #: DAAH0191CR263
PI: MORRIS YOUNG
Title: ELECTROMAGNETIC GAGE MEASUREMENT OF COUPLING IN JOINTED ROCK
Abstract: IN SUPPORT OF EXISTING AND PROPOSED NUCLEAR TEST LIMITATION TREATIES, IT IS INCREASINGLY IMPORTANT THAT IMPROVED METHODS FOR UNDERSTANDING AND PREDICTING THE SEISMIC COUPLING OF NUCLEAR DETONATIONS BE DEVELOPED. WITH THE POSSIBILITY OF BETTER DEFINE THE GEOLOGY EXISTING AT SOVIET TEST SITES, SUBTLE VARIATIONS IN COUPLING OF NUCLEAR DETONATIONS TO VARIOUS ROCK TYPES COULD BE IMPORTANT. ONE FEATURE OF NEARLY ALL ROCKS THAT COULD HAVE SIGNIFICANT INFLUENCE UPON COUPLING IS NATURAL JOING CHARACTER. PROPERLY DESIGNED AND EXECUTED SMALL AND INTERMEDIATE-SCALE EXPERIMENTS COULD ESTABLISH AND DELIMIT THE IMPORTANCE OF ROCK JOINT PROPERTIES AND JOINT DISTRIBUTIONS UPON SEISMICCOUPLING AND PROVIDE A BETTER BASIS FOR PREDICTING THE SEISMIC RESPONSE OF NUCLEAR TEST SITES. A CRITICAL ELEMENT OF SMALL AND INTERMEDIATE SCALE TESTING IS THE MEASUREMENT OF ROCK

RESPONSE. ELECTROMAGNETIC VELOCITY GAGE TECHNIQUES ARE IDEALLY SUITED FOR SUCH MEASUREMENTS AS GAGE OUTPUT DEPENDS DIRECTLY UPON FARADAY'S LAW OF INDUCTION RATHER THAN UPON SOME INDEPENDENTLY DETERMINED AND POSSIBLE TEST DEPENDENT CALIBRATION FACTORS. ELECTROMAGNETIC GAGE TECHNIQUES WOULD BE DEVELOPED AND APPLIED TO BOTH SMALL-SCALE LABORATORY AND INTERMEDIATE-SCALE FIELD TESTS. THE RESULTING DATA SHOULD DEMONSTRATE AND QUANTIFY THE EFFECT OF JOINTS UPON SEISMIC COUPLING IN NUCLEAR TESTS. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS OF THE RESEARCH OR DEVELOPMENT. THE TECHNIQUES AND DATA RESULTING FROM A PHASE I PROGRAM WOULD ALLOW FOR A MORE QUANTITATIVE EVALUATION OF THE ROLE OF ROCK JOINTS AND THEIR PROPERTIES ON SEISMIC COUPLING OF HIGH-EXPLOSIVE AND NUCLEAR DETONATIONS. THE RESULTS WOULD SUPPORT EFFORTS TO VERIFY EXISTING AND PROPOSED TEST BAN TREATIES. THE TECHNIQUES AND DATA WOULD BE APPLICABLE TO ROCK JOINT STUDIES IN MANY AREAS OF DYNAMIC ROCK MECHANICS, INCLUDING ROCK FRAGMENTATION IN COMMERCIAL BLASTING AND NOVEL SMALL-CHARGE EXCAVATION TECHNIQUES.

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Topic#: 91-076 ID#: 9110500
Office:
Contract #: DAAH0191CR160
PI: ED FUNK

Title: THE USE OF HIGH TEMPERATURE SUPERCONDUCTORS IN ELECTRONIC CIRCUITRY

Abstract: THE FOCUS OF THIS PHASE I PROPOSAL IS THE RESEARCH INTO THE USE OF HIGH TEMPERATURE SUPERCONDUCTORS (HTS) IN ELECTRONIC CIRCUITRY IN ORDER TO ENHANCE THE SPEED OF PERFORMANCE OF THE ELECTRONIC FUNCTION. THE RESISTIVITY OF THE CIRCUITRY CAUSES DELAY OF THE SIGNAL PROPAGATION. THIS DELAY IS A LARGE DETERMINANTS FACTOR IN THE ULTIMATE SPEED OF COMPUTERS AN OTHER HIGH FREQUENCY DEVICES. BY REDUCING TRANSPORTATION TIME AND MINIMIZING SIGNAL PHASE SHIFT OF THE ELECTRONIC SIGNAL FROM POINT A TO POINT B, THE SPEED OR RESPONSE IS INCREASED AND THE FREQUENCY OF RESPONSE IS ALSO INCREASED. THIS PHASE I PROJECT WILL ADDRESS THE APPLICATION OF HTS MATERIALS IN THE PRINTED CIRCUIT BOARD (ELECTRONIC WIRING CIRCUIT) AND IN THE COMPUTER BUSS. BOTH OF THESE AREAS ARE PRIME SIGNAL CARRYING PARTS OF INSTRUMENTS AND COMPUTERS AND IF THE SIGNAL TRANSPORTATION TIME CAN BE REDUCED IN THESE TWO AREAS THE OVERALL EQUIPMENT PERFORMANCE IS INCREASED. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS OF THE RESEARCH OR DEVELOPMENT. THE BENEFITS OF THIS TECHNOLOGY WILL BE IN HIGHER SPEED COMPUTERS AND BROADER BAND SIGNAL PROCESSING IN ALL TYPES OF ELECTRONIC EQUIPMENT AND INSTRUMENTATION. IT WILL RESULT IN MORE EFFICIENT RADAR SIGNAL PROCESSING WHILE TRACKING MORE TARGETS SIMULTANEOUSLY. COMMERCIAL COMPUTERS AND INSTRUMENTATION WILL ALSO BENEFIT FROM HIGHER SPEEDS AND TELECOMMUNICATIONS WILL BE IMPROVED.

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Topic#: 91-098 ID#: 9120948
Office: DSO
Contract #: DAAH0192CR014
PI: MARK JOHNSON

Title: APPLICATION OF HIGH TEMPERATURE SUPERCONDUCTORS TO ELECTRONIC CIRCUITRY

Abstract: SEI'S PROJECT OBJECTIVE IS TO DETERMINE EFFECTIVE USES OF HIGH-TEMPERATURE SUPERCONDUCTORS IN ELECTRONIC CIRCUITRY FOR IMPROVING OVERALL PROPERTIES OF SIGNAL DISPERSION, FREQUENCY RESPONSE, PACKING DENSITY, REDUCED CROSSTALK, AND REDUCED POWER DISSIPATION. SEI PERSONNEL WILL SELECT A REPRESENTATIVE ELECTRONICS ASSEMBLY SUITABLE FOR INCORPORATION OF SUPERCONDUCTING LEADS AND TRANSMISSION LINES, PRIORITIZE THE TYPES OF SUPERCONDUCTING INSERTIONS, AND EVALUATE THE COST BENEFITS OF EACH. SEI WILL ALSO INVESTIGATE INCORPORATION OF MODELS FOR SUPERCONDUCTING LEADS AND TRANSMISSION LINES INTO A CAD PROGRAM, WITH THE OBJECTIVE OF INCREASING THE ABILITY TO EVALUATE THE EFFECTIVENESS OF SUPERCONDUCTOR INSERTIONS INTO AN ELECTRONIC ASSEMBLY. WE WILL DETERMINE WHAT

MODIFICATIONS ARE REQUIRED TO THE CAD PROGRAM TO ENABLE IT TO OPTIMIZE THE CIRCUIT LAYOUT GEOMETRY ACCORDING THE SPECIAL PROPERTIES AND PROCESSING REQUIREMENTS OF SUPERCONDUCTORS. ANTICIPATED BENEFITS INCLUDE DEVELOPMENT OF THE TECHNOLOGY TO MODIFY A CAD PROGRAM TO OPTIMIZE THE CIRCUIT GEOMETRY OF HIGH-TEMPERATURE SUPERCONDUCTORS. CIRCUIT IMPROVEMENT INCLUDES REDUCING SIGNAL DISPERSION, BROADENING FREQUENCY RESPONSE, INCREASING PACKING DENSITY, REDUCING SIGNAL CROSSTALK, AND REDUCING POWER DISSIPATION. COMMERCIAL APPLICATIONS INCLUDE SALE OF THE MODIFIED CAD SOFTWARE PACKAGE DESCRIBED.

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Topic#: 91-060 ID#: 9110511
Office:
Contract #: DAAH0191CR167
PI: PETER CHOW

Title: STRAINED TYPE II SUPERLATTICE FOR LONG WAVELENGTH INFRARED DETECTORS

Abstract: AS AN ALTERNATIVE TO MERCURY-CADMIUM TELLURIDE (MCT), WE PROPOSE TO INVESTIGATE THE OPTICAL PROPERTIES OF A RECENTLY INVENTED CLASS OF TYPE II STRAINED-LAYER SUPERLATTICES MADE OF (GA, AS)RELATED COMPOUNDS. THE NEW CONCEPT HAS ADVANTAGES COMPARED WITH PREVIOUS EFFORTS IN THAT SMALL BAND-GAPS MAY BE ACHIEVED WITH SUFFICIENTLY THIN REPEATING LAYERS IN THE SUPERLATTICES SO THAT THEY HAVE GOOD OPTICAL ABSORPTION PROPERTIES AND FAVORABLE ELECTRICAL TRANSPORT PROPERTIES ORIGINAL CALCULATIONS HAVE INDICATED GA1-XINXSB/INAS TO BE THE BEST CHOICE FOR SUCH APPLICATION. VERY RECENTLY IT HAS BEEN SHOWN TO HAVE THE HIGHEST ABSORPTION COEFFICIENT AT 10UM WAVELENGTH COMPARED TO ALL OTHER SUPERLATTICE MATERIALS. TO EXPLORE THE POTENTIAL OF THIS MATERIAL SYSTEM, WE PROPOSE TO FABRICATE THEM BY MOLECULAR BEAM EPITAXY (MBE). THE MBE SYSTEM IS EQUIPPED WITH ADJUSTABLE COLUMN V CRACKER SOURCES AND THE GROWTH PROCESS IS AUTOMATED. THE SAMPLES WILL BE CHARACTERIZED OPTICALLY AND EVALUATED FOR INFRARED DETECTION APPLICATIONS IN THE 8-12 UM REGION. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS OF THE RESEARCH OR DEVELOPMENT. A VERY FAVORABLE OPTICAL PROPERTIES OF THE STRAINED-LAYER TYPE II SUPERLATTICES SUGGEST THAT THEY COULD BE VERY USEFUL FOR INFRARED DETECTORS AND DETECTOR ARRAYS USED IN SPACE ASTRONOMY, PHYSICS AND ATMOSPHERIC STUDIES, AS WELL AS MEDICAL AND INDUSTRIAL THERMAL IMAGING APPLICATIONS.

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Topic#: 91-077 ID#: 9110505
Office:
Contract #: DAAH0191CR254
PI: L. MCMILLAN

Title: THIN-FILM, HIGH DIELECTRIC CONSTANT, MICRON-SIZED CAPACITOR MATERIALS

Abstract: WE PROPOSE AN EXTENSIVE STUDY OF MATERIALS AND DEPOSITION TECHNIQUES SUITABLE FOR FABRICATION OF HIGH-DIELECTRIC CONSTANT THIN-FILM DRAM (DYNAMIC RANDOM ACCESS MEMORY) CAPACITORS. THESE CAPACITORS WILL MINIMIZE THE NEED FOR TRENCH PROCESSING IN SUBMICRON, HIGH DENSITY MEMORIES. OUR RESEARCH FIRM HAS HAD CONSIDERABLE SUCCESS SINCE 1985 USING SPUTTERING AND SOL-GEL (SPIN-ON) DEPOSITION TECHNIQUES. RECENTLY, WE HAVE DEVELOPED A PROTOTYPE U.V.-ASSISTED CVD MACHINE FOR FERROELECTRIC THIN FILM DEPOSITION AND RTA PROCESSING. WE ALSO HAVE EXPERIENCE WITH ELECTRON-BEAM EVAPORATION. THE MATERIALS WE ARE MOST EXPERIENCED WITH INCLUDE PBTIO3, PBZRO3, PZT, BAMGF4, YMNO3, BATIO3,AND SRTIO3. AT PRESENT, THE MOST FAVORED CAPACITOR MATERIAL FOR DRAM APPLICATION IN JAPAN IS SRXBA1XTIO3. THIS MATERIAL IS CURRENTLY USED BY NEC. NEC DEPOSITS THIS MATERIAL USING SPUTTERING TECHNIQUES. WE PROPOSE TO CHARACTERIZE FILMS PROCESSED USING SOL-GEL AND CVD TECHNIQUES. AT THE CONCLUSION OF OUR PHASE I STUDIES, WE WILL DELIVER A LISTING OF MATERIALS, COMPATIBLE WITH EXISTING SILICON VLSI PROCESSING TECHNOLOGY, WHICH EXHIBIT HIGH DIELECTRIC CONSTANT E(F) AT HIGH CLOCK RATES, NEGLIGIBLE AGING, AND GOOD TIME DEPENDENT D.C. BREAKDOWN CHARACTERISTICS. SYMETRIX ALSO PROPOSES TO PROVIDE A COMPARISON OF DEPOSITION TECHNIQUES

FOR EACH MATERIAL AND AN INITIAL SAMPLING OF 2 SAFERS WITH CAPACITOR STRUCTURES USING THE MOST PROMISING MATERIAL. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS OF THE RESEARCH OR DEVELOPMENT. IT IS LIKELY THAT THE SIO2 CAPACITIVE LAYER IN DRAMS (DIELECTRIC CONSTANT OF 10) CAN BE REPLACED WITH A FERROELECTRIC OR NEAR-FERROELECTRIC MATERIAL WITH A DIELECTRIC CONSTANT OF GREATER THAN 1000. THIS MAY ELIMINATE TRENCH PROCESSING IN SUBMISSION, HIGH DENSITY DRAMS (GREATER THAN 64 MB), A $10 BILLION/YEAR MARKET.

SYSTEMS & PROCESSES ENGINEERING CORP. Topic#: 91-001 ID#: 9110214
1406 SMITH ROAD Office:
AUSTIN, TX 78721 Contract #: DAAH0191CR198
Phone: (617) 527-8851 PI: GARY CHIN
Title: CAMOUFLAGE DETECTION BY LASER-INDUCED FLUORESCENCE (LIF) REMOTE SENSING
Abstract: RECENT SPECTRAL LUMINESCENCE INVESTIGATIONS INDICATE THAT CAMOUFLAGE FABRICS AND PAINTS HAVE UNIQUE SPECTRAL SIGNATURES THAT CAN BE EXPLOITED BY A LASER-INDUCED LUMINESCENCE REMOTE SENSOR. SPEC IS PROPOSING THE DEVELOPMENT OF A LASER INDUCED FLUORESCENE (LIF) LIFETIME SENSOR CAPABLE OF DISCRIMINATING CAMOUFLAGE MATERIALS AND PAINTS IN THE PRESENCE OF BACKGROUND VEGETATION AND SOILS, THUS RENDERING CURRENT AND FUTURE CAMOUFLAGES INEFFECTIVE. THE PROPOSED LIF REMOTE SENSOR USES PHASE-RESOLVED FLUORESCENCE SPECTROSCOPY (PRFS) FOR DETECTION OF CAMOUFLAGE MATERIALS. A MODULATED EXCITATION WAVELENGTH IS ABSORBED BY THE CAMOUFLAGE MATERIAL. THE FLOURESCENCE EMITTED BY THE LASER EXCITED COMPONENT IS PHASE-SHIFTED AND DEMODULATED FROM THE EXCITATION WAVELENGTH. SPEC'S INNOVATIVE SOFTWARE AND DIGITAL SIGNAL PROCESSING DESIGN FOR THIS LASER REMOTE SENSING SYSTEM INCORPORATES A DIGITAL OPTICAL PHASE-LOCK-LOOP (DOPLL) FOR HIGH RESOLUTION PHASE MEASUREMENT AND LIFETIME DETERMINATION. MODULATION FREQUENCY CAN BE VARIED FOR SELECTIVE FLUORESCENCE LIFETIME MEASUREMENTS WHICH RELIABLY IDENTIFY NATURAL AND MANMADE CAMOUFLAGE MATERIALS. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS OF THE RESEARCH OR DEVELOPMENT. THIS TECHNOLOGY WILL ALLOW THE SELECTIVE DETECTION OF CAMOUFLAGED TARGETS. LIF TECHNOLOGY WILL PROVIDE A MEANS FOR: CAMOUFLAGE, TARGET, AND UNIFORM DETECTION; CHEMICAL WEAPONS TREATY VERIFICATION; CHEMICAL DETECTION; ENVIRONMENTAL MONITORING; VEHICLE EMISSIONS MONITORING; AND CROP MONITORING.

SYSTEMS & PROCESSES ENGINEERING CORP. Topic#: 91-131 ID#: 9120190
1406 SMITH ROAD Office: LSO
AUSTIN, TX 78721 Contract #: DAAH0192CR113
Phone: (512) 385-0379 PI: NEWTON PENROSE
Title: MANEUVER SECURITY EXPERT PLANNING SYSTEM (MSEPS)
Abstract: SYSTEMS & PROCESSES ENGINEERING CORPORATION 'SPEC) IS PROPOSING TO DEVELOP A MANEUVER SECURITY EXPERT PLANNING SYSTEM (MSEPS). MSEPS IS A HIGH PAYOFF MINE AND AIR DEFENSE BARRIER CONCEPT THAT ASSISTS COMMANDERS TO PLAN FOR THE SECURITY OF U.S. ARMY AND U.S. MARINE CORPS MANEUVER ELEMENTS, PROVIDING INCREASED ECONOMY OF FORCE AND FLEXIBILITY. THE PROPOSED SYSTEM INTEGRATES A GEOGRAPHIC INFORMATION SYSTEM (GIS) AND KNOWLEDGE BASE APPLYING ARTIFICIAL INTELLIGENCE (AI) TECHNOLOGY TO ASSIST IN THE PLANNING FOR SECURITY OF MANEUVER ELEMENTS DRIVING DEEP INTO ENEMY REAR AREAS DURING AGGRESSIVE OFFENSIVE OPERATIONS. IN THE PHASE I PROGRAM, SPEC WILL: 1) DEMONSTRATE A MSEPS VISUAL PROTOTYPE ON A MACINTOSH 11 COMPUTER USING MACROMIND DIRECTOR TO PROVIDE SAMPLE SCREENS WITH ANIMATION OF A SAMPLE EXECUTION SCENARIO OF MSEPS; 2) CONDUCT A TRADE STUDY OF CANDIDATE GIS PACKAGES, AND KEY WEAPON SYSTEMS AND OTHER COUNTERMOBILITY SECURITY BARRIER DEVICES AND TECHNIQUES AVAILABLE FOR EMPLOYMENT BY MSEPS; AND 3) DEVELOP A DETAILED SYSTEM SPECIFICATION AND PHASE II IMPLEMENTATION PLAN. PHASE II PROGRAM WILL YIELD A MSEPS PROTOTYPE FOR FIELD EVALUATION BY DOD USERS. MSEPS TECHNOLOGY INSERTIONS WILL SUPPORT MULTI-ECHELON COMMAND AND CONTROL AND WEAPON SYSTEMS OPERATIONS. POTENTIAL

COMMERCIAL APPLICATIONS INCLUDE PLACEMENT OF SENSORS TO AID IN DRUG INTERDICTION ACROSS NATIONAL BOUNDARIES; AND IN MARKET RESEARCH SECTOR TO IDENTIFY LOCATIONS FOR FAST FOOD OUTLETS, SERVICE STATIONS, SHOPPING MALLS, AND MARKET SEGMENTS; AND IN SITING AND CONSTRUCTION OF BUILDINGS, BRIDGES, ROADWAYS, TO MEET DIVERSE REGULATIONS, STANDARDS, SPECIFICATIONS, AND USER REQUIREMENTS.

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Topic#: 91-206 ID#: 9121134
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Contract #: DAAH0192CR116
PI: JOHN TANNER
Title: MICRO POWER VLSI CELL LIBRARY
Abstract: WE PROPOSE TO DEVELOP A PARAMETERIZED CMOS CELL LIBRARY SPECIFICALLY FOR MICRO-POWER CIRCUITS. DURING PHASE I WE WILL CREATE THE LIBRARY GENERATION SOFTWARE, GENERATE A TYPICAL CELL SET, INCORPORATE THE CELLS INTO A TEST CHIP, HAVE THE TEST CHIP FABRICATED BY MOSIS, TEST THE CHIP, AND DOCUMENT THE LIBRARY. OUR EXPERIENCE DESIGNING THE SCMOSLIB MOSIS COMPATIBLE STANDARD CELL LIBRARY ALLOWS US TO PROPOSE AN ADVANCED PHASE I PROGRAM. DURING PHASE II WE WILL INTEGRATE THE LIBRARY GENERATOR WITH COMMERCIAL CAE SYSTEMS. WE WILL ADDRESS THE RELATIONSHIP BETWEEN THE GLOBAL SPEED AND POWER GOALS AND THE CHOICES OF PARAMETERS FOR SPECIFIC CELLS. WE ANTICIPATE A SUITE OF TOOLS THAT INCLUDE BOTH GOAL-DIRECTED SYNTHESIS OF CELLS AND ANALYSIS OF POWER CONSUMPTION. WE WILL ADD THE LIBRARIES AND SOFTWARE RESULTING FROM THIS EFFORT TO OUR SUITE OF LOW-COST CAE PRODUCTS ALREADY IN USE BY A MAJOR PORTION OF THE MOSIS COMMUNITY. THUS, MANY DESIGNERS WILL REAP IMMEDIATE BENEFIT FROM THIS R&D.

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Phone: (818) 795-1696
Topic#: 91-233 ID#: 9120633
Office: UWO
Contract #: DAAH0192CR117
PI: JOHN TANNER
Title: A REAL-TIME HIGH DENSITY CCD ARCHITECTURE
Abstract: WE PROPOSE TO DESIGN AND DEVELOP AN ARCHITECTURE FOR CCD READOUT THAT WILL ALLOW A SINGLE HIGH-DENSITY CCD SENSOR TO GENERATE REAL-TIME READOFF RATES OVER MULTIPLE PARALLEL OUTPUT PINS OR SLOWER READOFF RATES OVER A SMALLER NUMBER OF PINS (E.G. ONE). A SIMPLE MODIFICATION TO THE OUTPUT STRUCTURE WILL ALLOW A SINGLE CCD DESIGN TO SERVE MULTIPLE APPLICATIONS BY OPERATING IN DIFFERENT READOUT MODES CONTROLLED BY INPUTS TO THE CCD. DURING PHASE I WE WILL REFINE THE CONCEPT. WE WILL ANALYZE RELEVANT TECHNOLOGIES FOR PERFORMANCE, MANUFACTURABILITY, AND COST. OUR PHASE I EFFORT WILL INCLUDE THE DESIGN, MODELING, AND FABRICATION OF A SMALL CCD CHIP TO PROVE THE FEASIBILITY OF OUR DEVELOPMENT. OUR APPROACH WILL UTILIZE FABRICATION BY EITHER LORAL (FORD) AEROSPACE OR ORBIT SEMICONDUCTOR. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - A HIGH-DENSITY CCD CHIP THAT CAN AT ONCE SERVE REAL-TIME APPLICATIONS AND SINGLE-OUTPUT-TAP APPLICATIONS WOULD INCUR ONLY A SINGLE NRE CHARGE AND RIDE ON THE PRODUCTION VOLUMES OF BOTH. WE INTEND TO ACTIVELY MARKET PRODUCTS ARISING FROM THIS RESEARCH.

TAU CORP.
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Phone: (408) 395-9191
Topic#: 91-078 ID#: 9110575
Office:
Contract #: DAAH0191CR173
PI: PETER ROTHMAN
Title: HARDWARE NEURAL NETWORK IMPLEMENTATION FOR THE RECOGNITION OF CHEMICAL AND BIOLOGICAL WARFARE AGENTS
Abstract: RECENT DEVELOPMENTS IN THE FIELD OF ARTIFICIAL NEURAL NETWORKS HAVE DEMONSTRATED

THE UTILITY OF THESE SYSTEMS FOR A VARIETY OF PURPOSES INCLUDING PATTERN RECOGNITION, ASSOCIATIVE MEMORY, AND CONTROL. TO DATE, THE MAJORITY OF THESE APPLICATIONS HAVE BEEN IMPLEMENTED OF CONVENTIONAL SEQUENTIAL PROCESSORS OR FAST FLOATING POINT PROCESSORS. DURING THE PAST TWO YEARS, SIGNIFICANT PROGRESS HAS ALSO BEEN MADE IN THE DEVELOPMENT OF BOTH ANALOG AND DIGITAL NEURAL DEVICES. IN FACT THE STATE OF THE ART IS SUFFICIENTLY ADVANCED, THAT THESE DEVICES ARE AVAILABLE AS COMMERCIAL, OFF THE SHELF, PRODUCTS. THE UNITED STATES ARMY CHEMICAL RESEARCH, DEVELOPMENT, AND ENGINEERING CENTER (CRDEC) HAS BEEN EXPLORING A VARIETY OF TECHNOLOGIES CAPABLE OF DETECTING SUBTOXIC CONCENTRATIONS OF CHEMICAL AND BIOLOGICAL THREAT AGENTS. THE CHEMICAL BIOLOGICAL MASS SPECTROMETER (CBMS) PROGRAM IS ONE OF THE KEY PROJECTS IN ACHIEVING THE ARMY'S GOAL OF IMPROVING THE SURVIVABILITY OF U.S. FORCES TO CB ATTACK. THE CURRENT CBMS DESIGN INCORPORATES A NEURAL NETWORK, DEVELOPED BY TAU CORPORATION, FOR THE RECOGNITION OF CHEMICAL AND BIOLOGICAL WARFARE AGENTS FROM THEIR MASS SPECTRA; THIS NETWORK IS IMPLEMENTED IN SOFTWARE AN EXECUTES ON A CONVENTIONAL SEQUENTIAL PROCESSOR. IN THIS PROPOSED EFFORT, TAU, TOGETHER WITH OUR SUBCONTRACTOR TELEDYNE CME, WILL DEFINE A BOARD WHICH WILL INCORPORATE ARTIFICIAL NEURAL NETWORKS IMPLEMENTED IN HARDWARE. THIS BOARD WILL BE DESIGNED TO INTEGRATE SEAMLESSLY INTO THE EXISTING CBMS HARDWARE ARCHITECTURE.

TECHNICAL RESEARCH ASSOCIATES, INC.
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Topic#: 91-068 ID#: 9110170
Office:
Contract #: DAAH0191CR174
PI: EDWIN WINTER
Title: DUAL BAND MULTI-SPECTRAL FUSION FOR AIR VEHICLE DETECTION
Abstract: THE DETECTION OF AIR VEHICLES IS A CHALLENGING TECHNICAL PROBLEM. A LOW COST APPROACH USING PASSIVE SENSORS IN BOTH THE VISIBLE AND MID-RANGE INFRARED (MWIR) IS PROPOSED. THIS APPROACH EXPLOITS THE ADVANTAGES OF EACH SPECTRAL REGION. VISIBLE LIGHT PERFORMS WELL ONLY IN THE DAYTIME, ALTHOUGH CHEAP HIGH RESOLUTION FOCAL PLANES ARE POSSIBLE. MWIR CAN PERFORM IN THE DAY OR NIGHT BUT IS LIMITED GREATLY DURING THE DAY BY HIGH BACKGROUND CLUTTER. NEITHER SENSOR NEEDS ACTIVE COOLING. IN OUR APPROACH, SUB-BANDS WITHIN EACH SPECTRAL REGIME ARE PROCESSED USING A PRE-DETECTION FUSION TECHNIQUE TO REMOVE CLUTTER. THE SAME PROCESSING APPROACH CAN BE USED FOR DAYTIME SURVEILLANCE USING THE VISIBLE LIGHT REGION AND NIGHT TIME SURVEILLANCE USING MWIR. A LOW COST PROTOTYPE AND A DEMONSTRATION ARE PROPOSED. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS OF THE RESEARCH OF DEVELOPMENT. THE ANTICIPATED BENEFITS ARE NEW APPROACHES TO PASSIVE SURVEILLANCE OF AIR VEHICLES. LOW COST SOLUTIONS ARE POSSIBLE FOR MILITARY SURVEILLANCE OF CONTRABAND AIR TRAFFIC (DRUG SMUGGLERS).

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Topic#: 91-113 ID#: 9121206
Office: MTO
Contract #: DAAH0192CR114
PI: NATHAN HIGBIE
Title: USING A NEURAL NETWORK TO MONITOR HIGH SPEED PRODUCTION MACHINERY FOR QUALITY CONTROL
Abstract: AN APPLICATION OF A PROVEN SPEECH RECOGNITION NEURAL NETWORK TO MONITORING PRODUCTION LINE MACHINERY IS PROPOSED. THE NETWORK WILL BE USED TO DETECT MACHINE SET-UP CHANGES AND ANALYSIS WILL BE DONE TO DETERMINE IF THE TIME WAVEFORM DESCRIPTION CAN BE RELATED TO SET-UP AND TO PRODUCT QUALITY. THE PARTICULAR APPLICATION IS A MACHINE THAT PRODUCES HIGH VALUE METAL CANISTERS AT A HIGH SPEED. DATA HAVE BEEN COLLECTED FOR "GOOD" AND "BAD" SET-UP CONDITIONS FROM MICROPHONES, ACCELEROMETERS, LOAD AND FORCE SENSORS. TRADITIONAL SIGNAL PROCESSING TECHNIQUES HAVE BEEN USED ON THESE DATA AND CHANGES HAVE BEEN FOUND. HOWEVER, A PROCESS THAT AUTOMATICALLY LEARNS THE "GOOD" SET-UP AND THEN

DETECTS CHANGES WOULD SIGNIFICANTLY REDUCE MONITORING SYSTEM IMPLEMENTATION COST. SINCE THE DATA AND THE PROCESSING SOFTWARE ARE AVAILABLE, CONCEPT FEASIBILITY CAN BE READILY PROVEN IN PHASE I, AND A PROTOTYPE SYSTEM DEVELOPED IN PHASE II. A MANUFACTURING SYSTEM THAT MONITORS PRODUCT QUALITY AUTOMATICALLY AND THAT HAS BROAD APPLICATION WOULD FIND A WIDE ACCEPTANCE IN INDUSTRY.

TECHNOLOGY MODELING ASSOCIATES, INC.
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Topic#: 91-027 ID#: 9110661
Office:
Contract #: DAAH0191CR255
PI: DONALD BARRICK
Title: INTEGRATED TECHNOLOGY COMPUTER AIDED DESIGN
Abstract: TECHNOLOGY COMPUTER AIDED DESIGN (TCAD) TOOLS ARE NOW CRITICAL IN THE DESIGN AND MANUFACTURE OF INTEGRATED CIRCUITS. AS INDUSTRIAL INTEREST HAS GROWN, THE NUMBER OF SOURCES OF THESE TOOLS HAS INCREASED. EACH TOOL TYPICALLY USES A UNIQUE DATA REPRESENTATION, MAKING INTEGRATION OF SEVERAL TOOLS DIFFICULT. IN ADDITION, A NATURAL INTERACTION BETWEEN TCAD AND ELECTRONIC DESIGN AUTOMATION (EDA) TOOLS HAS BEEN RECOGNIZED, AND DATA SHARING IS NEEDED. THIS PROJECT PROPOSES TO INVESTIGATE AND RECOMMEND THE BEST WAY TO ADDRESS THE NEED TO TCAD INTEGRATION THROUGH A UNIFYING FRAMEWORK. THERE IS AN ONGOING INDUSTRY-WIDE EFFORT IN THIS AREA, THE TCAD FRAMEWORK INITIATIVE, AND TMA IS AN ACTIVE PARTICIPATE IN THIS ENTERPRISE. IN ADDITION, THE USE OF FRAMEWORKS HAS BEEN DEMONSTRATED FOR INTEGRATING MULTISOURCE EDA TOOLS. THESE SYSTEMS AND OTHERS WILL BE EVALUATED FOR THEIR APPLICABILITY TO TCAD. PHASE I OF THIS PROJECT WILL HAVE TWO DISTINCT STAGES: 1)THE FEASIBILITY AND PRACTICALITY OF A FRAMEWORK FOR TCAD TOOL INTEGRATION WILL BE INVESTIGATED; AND 2) A FUNCTIONAL DESIGN AND IMPLEMENTATION PLAN WILL BE DEVELOPED AND DELIVERED. THE RESULTS OF THIS PHASE I EFFORT WILL PROVIDE A PLAN FOR THE DEVELOPMENT OF AN INTEGRATED TCAD SYSTEM DURING PHASE II. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS OF THE RESEARCH OR DEVELOPMENT. THE REALIZATION OF THE INTEGRATED TCAD SYSTEM PROPOSED UNDER THIS PROJECT WILL BENEFIT TCAD TOOL USERS AND DEVELOPERS ALIKE. IT WILL BENEFIT USERS BY MAKING INDIVIDUAL TOOLS EASIER TO USE AND PROVIDE A MEANS TO EFFECTIVELY USE A SET OF TCAD TOOLS AS PART OF A TECHNOLOGY DESIGN METHODOLOGY.

TOP LEVEL, INC.
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Topic#: 91-036 ID#: 9110755
Office:
Contract #: DAAH0191CR222
PI: BRIAN MURRAY
Title: PROJECT CRISP
Abstract: THE OBJECTIVES OF THE PROPOSED RESEARCH ARE TO DESIGN A PARALLEL PROGRAMMING LANGUAGE, CALLED "CRISP," THAT SUPPORTS EXISTING C PROGRAMS AS A SUBSET OF THE LANGUAGE. CRISP SUPPORTS AUTOMATIC SYNCHRONIZATION, MULTIPLE GRAIN-SIZES OF PARALLELISM, AND A LARGE LIBRARY OF COMMON PARALLEL AND SERIAL PROGRAMMING CONSTRUCTS. THE PROPOSED STRATEGY FOR THIS PROJECT IS BASED ON UTILIZING AN EXISTING COMMERCIALLY AVAILABLE PARALLEL COMMON LISP SYSTEM AND DESIGNING A SYSTEM THAT TRANSLATES CRISP INTO COMMON LISP. THIS RESEARCH WILL RESULT IN THE DESIGN OF C-COMPATIBLE SYSTEMS THAT INCLUDE MANY OF THE ADVANCED CAPABILITIES OF A COMMON LISP SYSTEM. FEATURES SUCH AS OBJECTS, POLYMORPHISM, GARBAGE COLLECTION, INCREMENTAL COMPILATION, AND INTERACTIVE DEBUGGING THAT ARE INCREASINGLY BEING INCORPORATED INTO EXISTING C SYSTEMS. IN ADDITION TO THESE CAPABILITIES, CRISP ALLOWS THE USE OF FUTURE OBJECTS WHICH PROVIDE FOR AUTOMATIC SYNCHRONIZATION OF PARALLEL ACTIVITY, AND THE USE OF FINE-GRAINED PARALLELISM ALREADY PRESENT IN THE LIST SYSTEM. THIS PROJECT WILL ALLOW THE LARGE NUMBER OF EXISTING C PROGRAMMERS TO DEVELOP PARALLEL SOFTWARE USING A FAMILIAR, BUT MORE POWERFUL, PROGRAMMING LANGUAGE. ANTICIPATED

BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THIS PROJECT WILL EXTEND THE POWER OF THE C PROGRAMMING LANGUAGE BY ENABLING C PROGRAMS TO EXPLOIT THE INCREASED COMPUTE POWER OF PARALLEL HARDWARE SYSTEMS AND BY PROVIDING ADVANCED PROGRAMMING CAPABILITIES FROM THE COMMON LIST LANGUAGE. WITH THE RAPIDLY GROWING AVAILABILITY OF PARALLEL HARDWARE SYSTEMS, THE PARALLEL CAPABILITIES THIS PROJECT WILL BRING TO THE C LANGUAGE WILL RESULT IN SIGNIFICANT COMMERCIAL DEMAND.

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Topic#: 91-233 ID#: 9120606
Office: UWO
Contract #: DAAH0192CR021
PI: SEAN YANG
Title: FAST ARRAY READOUT ARCHITECTURE (FARA)
Abstract: CHARGE-COUPLED-DEVICE (CCD) DETECTORS HAVE BEEN STEADILY INCREASING IN RESOLUTION AS WELL AS OTHER PARAMETERS OFFERING SIGNIFICANT PERFORMANCE IMPROVEMENTS. ALTHOUGH 512X512 AND EVEN 1024X1024 PIXEL DDC CAMERAS ARE AVAILABLE WITH REAL-TIME READOUT, 2048X2048 PIXEL OR LARGER CCDS PRESENTLY CANNOT ACHIEVE THE REQUIRED 30 FRAMES PER SECOND. IN APPLICATIONS SUCH AS SURVEILLANCE, TRACKING AND HIGH DEFINITION TELEVISION, BOTH SPEED AND RESOLUTION ARE CRITICAL. THEREFORE,, AN ELEGANT AND COST EFFECTIVE SOLUTION MUST BE FOUND TO SUPPORT 2048X2048 PIXEL CCD ARRAYS AND EVEN LARGER DEVICES ALREADY BEING DEVELOPED. THE PROPOSED METHOD TO INCREASE THE ON CHIP READOUT RATE WILL USE INNOVATIVE PARALLEL READOUT ARCHITECTURES IN CONCERT WITH NOVEL HIGH SPEED SAMPLE AND HOLD CIRCUITS. THIS SOLUTION CAN BE EASILY SCALED UP TO HIGHER RESOLUTIONS WHILE MAINTAINING REAL-TIME READOUT RATES WHICH WILL REDUCE IF NOT ELIMINATE THE RESOLUTION VERSUS READ RATE TRADEOFF IN SPECIFIC CASES. APPLICATIONS IN SURVEILLANCE, TRACKING, SCIENTIFIC IMAGING AND HIGH DEFINITION TELEVISION WILL BENEFIT FROM A "REAL-TIME" 2048X2048 CCD CAMERA. THE PROPOSED SOLUTION ALSO ANTICIPATES AND OFFERS A SOLUTION TO READOUT RATE LIMITATIONS OF EVEN LARGER CCD COMING ON THE HORIZON.

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Topic#: 91-099 ID#: 9120105
Office: DSO
Contract #: DAAH0192CR028
PI: G. HEGEMIER
Title: CERAMIC SHIELDS FOR SATELLITE PROTECTION AGAINST HYPERVELOCITY IMPACT
Abstract: PHASE I IS A PILOT STUDY, THE OBJECTIVE OF WHICH IS TO EXPLORE THE APPLICATION OF STRUCTURAL CERAMICS IN STAND-OFF SHIELDS AGAINST HYPERVELOCITY IMPACT. FOR THIS PURPOSE, SEVERAL PRELIMINARY SHIELD DESIGNS WILL BE CONSIDERED. EACH DESIGN WILL BE MODELED NUMERICALLY, AND COMPUTER SIMULATIONS OF A SUITE OF HYPERVELOCITY IMPACT EVENTS WILL BE PERFORMED IN AN EFFORT TO ASSESS SHIELD PERFORMANCE. THESE COMPUTER SIMULATIONS WILL BE BASED UPON AN ADVANCED PHYSICALLY-BASED MODEL OF CERAMICS WHICH WAS RECENTLY DEVELOPED BY TRANS-SCIENCE CORPORATION FOR APPLICATION TO ARMOR/ANTI-ARMOR PROBLEMS. SHIELD EFFECTIVENESS WILL BE MEASURED AGAINST THE PERFORMANCE OF STANDARD ALUMINUM STAND-OFF SHIELDS. THE ADVANTAGES OF CERAMIC-BASED SHIELDS WILL BE DELINEATED AND A CANDIDATE DESIGN WILL BE SELECTED FOR A MORE DETAILED THEORETICAL/EXPERIMENTAL STUDY IN PHASE II. STAND-OFF SHIELD FOR ALL LONG-TERM SPACECRAFT/SATELLITES.

TRELLIS SOFTWARE & CONTROLS, INC.
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Phone: (313) 853-0700
Topic#: 91-050 ID#: 9110347
Office:
Contract #: DAAH0191CR219
PI: KENNETH STODDARD
Title: DESIGN OF AN NGC/SPARC-BASED MACHINE TOOL CONTROLLER

Abstract: THE PROPOSED PROJECT CONSISTS OF THE DESIGN OF ANEW MACHINE TOOL CONTROLLER THAT WILL MARRY NEXT GENERATION CONTROLLER (NGC) TECHNOLOGY WITH AN ADVANCED RISC HARDWARE PLATFORM. THE RESULTING MACHINE TOOL CONTROLLER'S COMPUTATIONAL POWER SHOULD BE MORE THAN TEN TIMES GREATER THAN THAT OF EXISTING CONTROLLERS, RESULTING IN HIGHER ACCURACY PATHS, BETTER SURFACE FINISH, AND FASTER CYCLE TIMES. THE USE OF A SUN SPARC STATION FRONT END WILL LEVERAGE OFF THE HIGH MARKET VOLUMES AND RAPID PERFORMANCE INCREASES BEING DRIVEN BY OTHER MARKETS. IT WILL ALSO PROVIDE CONNECTIVITY TO A VARIETY OF NETWORKING PRODUCTS, SIMPLIFYING FACTORY INTEGRATION. THE NEW SPOX REAL-TIME OPERATING SYSTEM FOR THE DIGITAL SIGNAL PROCESSORS IN THE PROPOSED CONTROLLER WILL ENHANCE THE PORTABILITY AND SCALABILITY OF NGC APPLICATION SOFTWARE AND WILL ENABLE A LARGE QUANTITY OF SOFTWARE WRITTEN FOR OTHER APPLICATIONS TO BE USED ON THIS CONTROLLER. THE PROPOSED ARCHITECTURE WILL ALSO USE NEW MOTION CONTROL TECHNOLOGY DEVELOPED FOR ROBOT CONTROLLERS THAT IMPLEMENTS ADVANCED FEATURES SUCH AS ADAPTIVE CONTROL AND MULTI-MACHINE COORDINATION. THE PROPOSED CONTROLLER WILL ALSO BE ABLE TO BE USED IN A WIDE VARIETY OF APPLICATIONS THAT EXTEND BEYOND MACHINE TOOLS, SUCH AS ROBOTIC CONTROL, GENERAL MOTION CONTROL, AND PROCESS CONTROL APPLICATIONS. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THE COMPUTATIONAL POWER OF THE PROPOSED CONTROLLER ENABLES TRAJECTORY GENERATION AT THE SAME RATE AS CONTROL LAW EXECUTION, RESULTING IN HIGHER ACCURACY PATHS, BETTER SURFACE FINISH AND FASTER CYCLE TIMES. THE CONTROLLER'S FLEXIBLE, EXPANDABLE, MODULAR, OPEN ARCHITECTURE ENABLE CONTINUAL MODULE IMPROVEMENTS TO BE DEVELOPED BY SMALL ENTREPRENEURIAL SOFTWARE COMPANIES (A UNIQUE U.S. STRENGTH).

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2820 E. COLLEGE AVENUE, SUITE J
STATE COLLEGE, PA 16801
Phone: (805) 498-7541

Topic#: 91-077 ID#: 9110478
Office:
Contract #: DAAH0191CR256
PI: DOUGLAS HOLMES

Title: RELAXOR FERROELECTRIC PB(MG1/3NB2/3)03 FOR THIN FILM CAPACITORS

Abstract: THIS PROGRAM'S OBJECTIVE IS TO ESTABLISH THE RELAXOR FERROELECTRIC PB(MG1/2NBS/3)O3 (PMN) AS THE MATERIAL OF CHOICE FOR THIN FILM CAPACITORS IN DRAM AND ELECTRONIC PACKAGING APPLICATIONS.IN CONTRAST TO "NORMAL" FERROELECTRICS, E.G., BATIO3 AND PZT, RELAXORS OFFER HIGH DIELECTRIC CONSTANTS (K > 10,000), BROAD PHASE TRANSITIONS,LOW E-FIELD DEPENDENCY OF K, AND LARGE RXC TIME CONSTANTS. IN ADDITION, THE DIELECTRIC PROPERTIES ARE LESS DEPENDENT ON MICROSTRUCTURAL FEATURES SUCH AS GRAIN SIZE OWING TO THE NANOMETER STRUCTURAL ORIGIN OF RELAXOR BEHAVIOR. IN THE PHASE I PROGRAM TWO DEPOSITION TECHNIQUES (2) SOL-GEL SPIN COATING AND (2) EXCIMER LASER ABLATION ARE PROPOSED TO PREPARE PMN-BASED FILMS. A DETAILED PROCESS-PROPERTY CORRELATION STUDY IS SCHEDULED IN PHASE I TO ALLOW OPTIMIZATION OF FILM CAPACITORS. EXTENSIVE DEVICE CHARACTERIZATION, IN TERMS OF FILM DEPOSITION AND PATTERNING TO INSURE HIGH RELIABILITY IS PLANNED FOR PHASE II INCLUDING SCALING-UP FOR ULTIMATE DRAM AND ELECTRONIC PACKAGING IMPLEMENTATION. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS OF THE RESEARCH OR DEVELOPMENT. THE PLANNED PROGRAM THROUGH PHASE II, WILL ESTABLISH RELAXOR FERROELECTRIC (PMN-BASED) MATERIALS AS THE DIELECTRIC OF CHOICE FOR THIN FILM CAPACITORS. IN CONJUNCTION WITH THE APPROPRIATE DEPOSITION TECHNIQUE, RELAXOR THIN FILM CAPACITORS WILL HELP LEAD TO THE NEXT GENERATION OF DRAMS AND SEMI-CONDUCTOR PACKAGING.

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Topic#: 91-028 ID#: 9110091
Office:
Contract #: DAAH0192CR020
PI: PHILIP RIMA

Title: REAL TIME MONITORING OF INFRARED DETECTED THERMAL SIGNATURES OF TAB INTERCONNECTIONS

...

Abstract: WE HAVE PREVIOUSLY DESIGNED AN INSPECTION STATION IMPLEMENTING INFkARED DETECTED THERMAL SIGNATURES FOR THE MONITORING OF MECHANICAL INTEGRITY OF TAPE AUTOMATED BONDED (TAB) INTERCONNECTIONS. IN THIS RESEARCH WE WISH TO APPLY VARIOUS SIGNAL PROCESSING TECHNIQUES TO THIS DESIGN IN ORDER TO EVALUATE THE FEASIBILITY OF USING THIS MODIFIED WORK STATION TO MONITOR THE TRANSMISSION LINE CHARACTERISTICS OF THE TAB BONDED INTERCONNECTIONS. THERE IS A NEED FOR THIS WORK STATION BECAUSE MUCH THE ESCALATING EXPENSE IN THE MULTICHIP MODULE FABRICATION IS BROUGHT ON BECAUSE OF THE INABILITY TO MONITOR THE ELECTRICAL QUALITIES OF THE INTERCONNECTIONS, SUCH AS IMPEDANCE PERTURBATIONS AND DISCONTINUITIES, AND CROSS TALK, WHEN HIGH QUALITY ELECTRICAL SIGNALS ARE REQUIRED FOR RELIABLE OPERATION. THE PROPOSED WORK STATION IS COMPLETELY AUTOMATED, AND WE WILL EVALUATE THE FEASIBILITY OF USING SIGNAL PROCESSING TECHNIQUES FOR OBTAINING REAL TIME MEASUREMENTS OF THE ELECTRICAL CHARACTERISTICS AT THE INSPECTION STATION. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS OF THE RESEARCH OR DEVELOPMENT. IF THIS RESEARCH IS SUCCESSFULLY COMPLETED, WE WILL BE ABLE TO REDUCE FABRICATION COSTS OF MULTICHIP MODULES UP TO EIGHTY PERCENT BY IMPLEMENTING IN-SITU MONITORING OF THE ELECTRICAL CHARACTERISTICS WHILE THE MODULES ARE BEING ASSEMBLED. THESE COSTS WILL BE REDUCED BY REDUCTION OF REWORK NOW REQUIRED AFTER ELECTRICAL INSPECTION.

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Topic#: 91-204 ID#: 9120484
Office: ESTO
Contract #: DAAH0192CR098
PI: BOB LARGENT
Title: CONNECTOR TECHNOLOGIES
Abstract: A INCLUDED RIBBON WIRING HARNESS IS PROPOSED THAT CAN BE WORN BY INDIVIDUAL MILITARY PERSONNEL PROVIDING A LOCAL AREA NETWORK FOR ELECTRONIC SUBSYTEMS AND TRANSDUCERS PLACED AT REQUIRED POSITIONS ON THE BODY TO FACILITATE HANDS-FREE OPERATION OF PERSONAL COMMUNICATIONS AND DIGITAL DATA SYSTEMS. THIS HARNESS IS DESIGNED TO BE ATTACHED TO MILITARY CLOTHING OR WEB GEAR. IT WILL IN NO WAY HINDER BODY MOVEMENT OR RADIATE UNACCEPTABLE LEVELS OF ELECTROMAGNETIC ENERGY, AND WILL PROVIDE RELIABLE OPERATION OVER AN EXTENDED LIFETIME EXPOSED TO THE FLEXURE, STRESS, AND HARSH ENVIRONMENTAL CONDITIONS OF MILITARY OPERATIONS. 1. A HIGHLY FLEXIBLE, LIGHTWEIGHT, PERSONAL LOCAL AREA NETWORK HARNESS. 2. LOW PROFILE HARNESS, WITHOUT LOOSE CABLE ENDS AND LOOPS. 3. HIGH MEAN TIME BETWEEN FAILURE. 4. LOW RF EMISSIONS AND ACOUSTICAL NOISE DUE TO CABLE FLEXURE.

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Phone: (508) 897-0684
Topic#: 91-054 ID#: 9110626
Office:
Contract #: DAAH0191CR221
PI: THOMAS CALLAHAN
Title: INTEGRATION OF MULTI-SPECTRAL SENSORS IN MODULAR OPEN ARCHITECTURE CONTROLLERS FOR PRECISION....
Abstract: ADVANCED WEAPON SYSTEMS AND SPACE APPLICATIONS REQUIRE PRECISION PARTS WITH BETTER SURFACE FINISHES. AS MACHINE TOOL AUTOMATION INCREASES, MACHINIST'S SKILLS DECLINE WITH DISUSE AND EXACERBATES QUALITY PROBLEMS. YET THE MACHINIST'S INTUITIVE INTERACTION WITH THE MACHINING PROCESS IS CURRENTLY AN INDISPENSABLE SKILL COMPONENT. SUCH MACHINIST INTERACTION COULD, IN THE FUTURE, BE REPLACED WITH STRATEGIC DEPLOYMENT OF AN INTEGRATED MULTI-SPECTRAL SENSOR (IMSS) PACKAGE TO MONITOR MACHINE PERFORMANCE, CONDITION SIGNALS AND FUSE DATA FROM MULTIPLE SOURCES WITH AN AUTONOMOUS INTELLIGENT SYSTEM MODULE (AISM). UREA'S PHASE I OBJECTIVE IS TO ESTABLISH FEASIBILITY OF DEVELOPING A GENERIC OPEN-ARCHITECTURE IMSS/AISM TO MONITOR METAL CUTTING, INCLUDING IDENTIFICATION OF: TIME VARYING MACHINING PROBLEMS (TOOL WEAR); ARCHITECTURE FOR INTEGRATING AN EXPERT SYSTEM AND MACHINE LEARNING PLATFORMS TO DEAL WITH DYNAMIC, UNPREDICTABLE CHANGES; ARCHITECTURE REQUIREMENTS TO

INTERFACE WITH EXISTING COMPUTER CONTROLLERS; DESIGN SPECIFICATIONS FOR IMSS/AISM (HARDWARE & SOFTWARE); EXPERIMENTAL PROTOCOL AND COMPUTER SIMULATION STRATEGY TO BE CARRIED OUT IN PHASE II. THE APPROACH IS PREDICATED ON A SYNERGISTIC AMALGAM OF CRITICAL TECHNOLOGY AREAS, INCLUDING MACHINE INTELLIGENCE/LEARNING, SENSOR DATA FUSION, ADAPTIVE CONTROL, GROUP TECHNOLOGY & GRAPHICS-DATA BASE DESIGN. THE GENERIC, FLEXIBLE, OPEN-ARCHITECTURE IMSS/AISM DESIGN CAN BE ADAPTED FOR USE IN MANY MACHINING OPERATIONS WITHOUT BEING LIMITED TO SPECIFIC MACHINE/CUTTING TOOLS. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - IMPORTANT BENEFITS FROM IMSS/AISM WILL BE CONSISTENT HIGH QUALITY MACHINED PARTS, MORE EFFICIENT PROCESS PLANS, MUCH LESS DEPENDENCY ON THE UNPREDICTABLE HUMAN VARIABLES, AND GREATER CONTROL OVER MACHINE SHOP COSTS. THE COMMERCIAL POTENTIAL OR THE TECHNOLOGY IS SIGNIFICANT,E.G., NEW MACHINE TOOLS AND RETROFIT.

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Topic#: 91-185 ID#: 9120920
Office: SSTO
Contract #: DAAH0192CR023
PI: JEFF FANG
Title: SEMANTIC SEARCH OF INFORMATION DATABASES
Abstract: THIS RESEARCH WILL DEVELOP A METHODOLOGY FOR UTILIZING A LEXICAL DATABASE IN A STATISTICAL RETRIEVAL MODEL TO IMPROVE RETRIEVAL PERFORMANCE (I.E., RECALL AND PRECISION). THE SESAME ARCHITECTURE PROPOSED IN THIS PROPOSAL WILL UTILIZE THE LEXICAL DATABASE IN FOUR MAJOR PHASES OF RETRIEVAL: (1) DOCUMENT ANALYSIS; (2) QUERY FORMULATION; (3) RETRIEVAL AND RANKING; AND (4) QUERY REFORMULATION. A PROTOTYPE WILL BE BUILT TO VERIFY THE EFFECTIVENESS OF SESAME USING A SET OF DOCUMENT DATABASES DEVELOPED AT THE CORNELL UNIVERSITY. WORDNET, A LARGE LEXICAL DATABASE DEVELOPED AT PRINCETON UNIVERSITY, WILL BE USED IN THIS PROJECT. THE ANTICIPATED BENEFIT IS A METHODOLOGY WHICH WILL IMPROVE THE EFFECTIVENESS OF METHODS BASED ON PURELY BOOLEAN KEYWORD SEARCH OR THE STATISTICAL MODEL. IN THE PHASE I RESEARCH, THE METHODOLOGY WILL BE DEVELOPED AND A PROTOTYPE WILL BE BUILT. THE RESULTS FROM THIS RESEARCH WILL HAVE HUGE MARKET POTENTIAL IN PERSONAL INFORMATION MANAGEMENT SYSTEMS, OFFICE INFORMATION SYSTEMS, LIBRARY SYSTEMS, AND WIDE-AREA INFORMATION SERVERS.

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Phone: (408) 867-2291
Topic#: 91-156 ID#: 9120234
Office: ESTO
Contract #:
PI: GEORGE VENDELIN
Title: LARGE-SIGNAL CAD MODELS OF SCHOTTKY BARRIER STRUCTURES
Abstract: A NEW SCHOTTKY BARRIER DIODE MODEL HAS BEEN DEVELOPED WHICH IS BASED UPON THE PHYSICAL STRUCTURE OF THE SEMICONDUCTOR. THIS MODEL CAN BE USED FOR LARGE-SIGNAL MODELS OF MICROWAVE SCHOTTKY DIODES AND MICROWAVE MESFET STRUCTURES. BY INCLUDING BOTH LARGE-SIGNAL AND SMALL-SIGNAL CAPACITANCES FOR ARBITRARY DOPED STRUCTURES AND THE CORRECTIONS FOR FRINGING CAPACITANCES, A MORE ACCURATE LARGE-SIGNAL MODEL CAN BE PRESENTED IN A NEW CAD FORMAT. IT CAN EASILY BE SHOWN THE RATIO OF STATIC TO INCREMENTAL CAPACITANCE IS 1.0 FOR A PARALLEL-PLATE CAPACITOR, 2.0 FOR A UNIFORMLY DOPED SCHOTTKY DIODE, AND MUCH LARGER FOR OTHER DOPING PROFILES. ACCURATE KNOWLEDGE OF THIS RELATIONSHIP IS ESSENTIAL FOR THE CORRECT ANALYSIS OF LARGE-SIGNAL CIRCUITS. THIS IMPROVEMENT TO THE DEVICE MODELS WILL ALLOW MORE ACCURATE CIRCUIT DESIGNS OF NONLINEAR CIRCUITS INCLUDING POWER AMPLIFIERS, HIGH-LEVEL MIXERS, HARMONIC GENERATORS, OSCILLATORS, ETC. BY INCLUDING ALL OF THE STORED CHARGE EFFECTS IN A CONSISTENT FORMAT WHICH IS NOT PRESENTLY USED. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - THIS IMPROVED MODEL CAN BE ADDED TO MICROWAVE SOFTWARE PRESENTLY AVAILABLE FROM EESOF, COMPACT SOFTWARE, AND HEWLETT PACKARD. IT CAN ALSO BE ADDED TO SPICE MODELS AVAILABLE FROM NUMEROUS VENDORS INCLUDING MICROSIM AND META SOFTWARE.

WIZDOM SYSTEMS, INC.
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Topic#: 91-052 ID#: 9110358
Office:
Contract #: DAAH0191CR220
PI: DENNIS WISNOSKY

Title: WIZARD: AN INTEGRATED DESIGN AND MANUFACTURABILITY ANALYSIS TOOL SET

Abstract: WIZDOM SYSTEMS, INC., A PIONEER IN THE DEVELOPMENT OF CIE/CIM SOFTWARE AND INTEGRATED METHODOLOGIES, PROPOSES FOR PHASE I TO DETERMINE SOFTWARE DESIGN REQUIREMENTS AND SPECIFICATIONS FOR WIZARD, A SOFTWARE ENVIRONMENT FOR INTEGRATED DESIGN AND MANUFACTURABILITY ANALYSIS (IDMA). WHEN COMPLETE, THE WIZARD SYSTEM WILL INTEGRATE THE NOW SEPARATE PROCESSES OF PRODUCT DESIGN, DESIGN EVALUATION, AND MANUFACTURABILITY ANALYSIS THROUGH A SOFTWARE ARCHITECTURE WHICH ALLOWS OBJECTS WITHIN A CAD DRAWING TO BE DEFINED WITH SCALABLE PARAMETERS.WIZARD WILL PROVIDE THESE FEATURES THROUGH THE FOLLOWING INTEGRATED SOFTWARE TOOL SET: 1) FULL-FEATURED CAD ENVIRONMENT (USING SCALABLE OBJECTS); 2) MATERIAL PROPERTY REQUIREMENTS RESOLVER; 3) MATERIAL STRUCTURAL ANALYZER; AND 4) ASSEMBLY PROCESS SIMULATOR. THESE TOOLS WILL ENABLE THE VARIOUS PHASES OF PRODUCT DEVELOPMENT TO BE TIED TO COMMON CAD DRAWING FILES WHICH WILL ALSO CONTAIN ADDITIONAL INFORMATION ABOUT:MATERIALS USED, STRUCTURAL PROPERTIES, AND INFORMATION ABOUT OTHER PARTS AND TOOLS USED DURING PRODUCT ASSEMBLY. ADDITIONAL DELIVERABLES FOR PHASE I WILL INCLUDE A DETAILED OPERATIONAL SCENARIO OF THE WIZARD INTEGRATED DESIGN ENVIRONMENT AND A SOFTWARE DEVELOPMENT PLAN FOR CREATING A BETA QUALITY RELEASE OF THE WIZARD. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS - WIZARD WILL REDUCE LIFE CYCLE COSTS AND IMPROVE QUALITY BY PRODUCING OPTIMAL MECHANICAL DESIGNS. WIZARD WILL REDUCE ENGINEERING DESIGN TIME AND COSTS. SUCH BENEFITS WILL BE WIDELY APPLIED IN COMMERCIAL ENTERPRISES TO INCREASE COMPETITIVENESS AND PROFITS. WIZDOM SYSTEMS, INC. INTENDS TO INTRODUCE COMMERCIAL PRODUCTS BASED ON THE PHASE II.

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Topic#: 91-056 ID#: 9110161
Office:
Contract #: DAAH0191CR274
PI: RICHARD MINCH

Title: SHAPED MEMORY ALLOY COMPOSITES FOR HIGH FREQUENCY ACTUATORS

Abstract: SHAPED MEMORY ALLOY (SMA) COMPOSITE MATERIALS ARE PROPOSED WHICH ARE CAPABLE OF EXTREMELY FAST RESPONSE TIMES, CAN BE FORMED INTO SURFACES WHICH WILL EXHIBIT INDEPENDENTLY CONTROL OVER EACH OF THE RADIUS OF CURVATURE OF THE SURFACE, SHOW MORE UNIFORM AUSTENITE-MARTENSITE TRANSFORMATION PROPERTIES, ARE EXPECTED TO EXHIBIT IMPROVED FATIGUE-LIFE PROPERTIES, AND WILL HAVE INCREASED FORCE-DISPLACEMENT PERFORMANCE. HEAD TRANSFER CALCULATIONS FOR SMA ELECTRICAL ACTUATORS ARE PERFORMED, METALLURGICAL CONSIDERATIONS ARE DISCUSSED, PROOF-OF-PRINCIPLE SAMPLES ARE PROPOSED, AND SURFACE APPLICATIONS FOR TORPEDOES ARE DISCUSSED. FIGURES SHOW PERFORMANCE DATA, PHOTOMICROGRAPHS OF MATERIAL CROSS-SECTIONS, AND APPLICATION CONFIGURATIONS. ANTICIPATED BENEFITS/POTENTIAL COMMERCIAL APPLICATIONS OF THE RESEARCH OR DEVELOPMENT. VERY FAST SMA ELECTRICAL ACTUATORS FOR ROBOTICS, STRUCTURAL DAMPING, LOWER COST AND SMALLER REPLACEMENT FOR MECHANICAL AND HYDRAULIC ACTUATORS, REMOTE FLUID CONTROL DEVICES, OPTICAL DEVICES, OPTICAL DEVICES, AND WEAPON SYSTEM COMPONENTS. IN ADDITION, IMPROVED FATIGUE AND FORCE-DISPLACEMENT PERFORMANCE WILL OPEN NEW MARKETS TO SMA ACTUATORS.

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Topic#: 91-208 ID#: 9120189
Office: SSTO
Contract #: DAAH0192CR069
PI: ROMEL RIVERA

Title: THE XINOTECH TRANSLATION ENVIRONMENT FROM OTHER LANGUAGES INTO ADA
Abstract: XINOTECH HAS RESEARCHED AND DEVELOPED A LANGUAGE-BASED, LANGUAGE-INDEPENDENT, FORMALLY-GENERATED INTERACTIVE PROGRAMMING ENVIRONMENT. THIS TECHNOLOGY IS COMMERCIALLY AVAILABLE FOR ADA, CMS-2 AND OTHER LANGUAGES. DURING THE PHASE II OF SBIR N89-149, XINOTECH DEVELOPED AN INTEGRATED LANGUAGE-INDEPENDENT ENVIRONMENT FOR REVERSE ENGINEERING, USING ATTRIBUTE GRAMMARS FOR SEMANTIC SPECIFICATION. THE TOOLS LAYER INCLUDES PROTOTYPES FOR A SOURCE TO SOURCE TRANSLATOR XLT, A GRAPH ABSTRACTOR XGA, AND A GUIDELINE, STANDARDS AND METRICS ANALYZER XG&M; ALL FOUR INDEPENDENT OF SOURCE AND DESTINATION LANGUAGES. THE LANGUAGE-INDEPENDENT ARCHITECTURE IS SUPPORTED THROUGH XML, THE XINOTECH META-LANGUAGE. IT IS PROPOSED THAT FOR DARPA91-208 THE TRANSLATOR BE ENHANCED WITH A PATTERN ABSTRACTOR TO REDUCE SOURCE CODE PATTERNS INTO HIGH-LEVEL ADA STRUCTURES, SO USEFUL TO TRANSLATE OPERATING SYSTEM MULTI-TASKING DEPENDENCIES. ABSTRACTION PATTERNS WILL BE SPECIFIED USING XPAL, A SUBLANGUAGE OF XML. AS PART OF DARPA91-208, XLT (AND THE REST OF THE REVERSE-ENGINEERING ENVIRONMENT) WILL BE INSTANTIATED FOR CMS-2 TO ADA, JOVIAL TO ADA AND FORTRAN TO ADA. SUCCESSFUL DEVELOPMENT OF THIS ENVIRONMENT WILL PRODUCE A FORMALLY-SPECIFIED, FULLY CUSTOMIZABLE, RETARGETABLE TRANSLATOR, SO APPLICABLE TO CUSTOMIZE DIALECT AND OPERATING SYSTEM DEPENDENCIES. IT WILL BE FUNCTIONALLY INTEGRATED INTO XINOTECH'S POWERFUL FORWARD- AND REVERSE-ENGINEERING INTERACTIVE ENVIRONMENT. THIS ENVIRONMENT WILL MAKE POSSIBLE THE TRANSLATION TO ADA OF EXPENSIVE EXISTING SOFTWARE, AT A FRACTION OF THE COST. IT WILL ENHANCE THE REUSE AND SEE CAPABILITIES OF THE STARS PROGRAM. AT LITTLE EXTRA COST, THE TRANSLATOR CAN BE INSTANTIATED FOR OTHER MEMBERS OF THE CMS-2, JOVIAL AND FORTRAN FAMILIES, PASCAL, C, COBOL AND OTHERS TO ADA.

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Topic#: 91-209 ID#: 9120171
Office: SSTO
Contract #: DAAH0192CR180
PI: ROMEL RIVERA

Title: THE XINOTECH FORMAL SPECIFICATION OF OBJECT ABSTRACTION TOOLS FOR ADA RE-ENGINEERING
Abstract: XINOTECH HAS RESEARCHED AND DEVELOPED TECHNOLOGY FOR A LANGUAGE-BASED, LANGUAGE-INDEPENDENT, FORMALLY-GENERATED, ATTRIBUTE GRAMMAR-BASED, INTERACTIVE PROGRAMMING ENVIRONMENT, COMMERCIALLY AVAILABLE FOR ADA, CMS-2 AND OTHER LANGUAGES. THE OBJECTIVE OF THE PROPOSED RESEARCH IS TO USE THIS TECHNOLOGY TO BUILD A LANGUAGE-INDEPENDENT, SEMANTIC-BASED, FORMALLY-SPECIFIED ENVIRONMENT FOR REVERSE ENGINEERING, INTEGRATED FOR FORWARD ENGINEERING, INSTANTIATED FOR ADA. THE TOOLS LAYER WILL INCLUDE XOA, THE OBJECT ABSTRACTOR, AND XCA, THE CONTROL ABSTRACTOR FOR DESIGN RECOVERY. XOA WILL BE SUPPORTED BY XOI, THE OBJECT IDENTIFIER, FOR THE AUTOMATIC IDENTIFICATION OF OBJECTS IN EXISTING ADA CODE, AND XOC, THE OBJECT CONSTRUCTOR, FOR THE AUTOMATIC TRANSFORMATION OF THE ADA CODE TO REFLECT THE NEWLY IDENTIFIED OBJECTS. XOA WILL MAKE USE OF USER-DEFINABLE OBJECT-ORIENTED SPECIFICATION LANGUAGES TOOLS TO CAPTURE THE ABSTRACTED DESIGNS AND TO FORMALIZE THE OTHERWISE IMPLICIT OBJECT RELATIONSHIPS IN THE ADA CODE. THESE TOOLS WILL COMPLEMENT OTHER XINOTECH TOOLS (XG&M, THE GUIDELINES, STANDARDS AND METRICS ANALYZER, AND XLT, THE LANGUAGE TRANSLATOR). THESE TOOLS WILL BE BUILT ON TOP OF THE LANGUAGE-INDEPENDENT ARCHITECTURE SUPPORTED BY XML, THE XINOTECH META-LANGUAGE, AND XPAL, WHICH IS XML'S SUBLANGUAGE FOR SPECIFYING THE PATTERN ABSTRACTION MAPPINGS THAT WILL DEFINE THE OBJECT CONSTRUCTION PROCESS IN XOC. THESE TOOLS WILL BE OPEN SYSTEMS WITH IMMEDIATE COMMERCIAL AVAILABILITY. SUCCESSFUL DEVELOPMENT OF THIS ENVIRONMENT WILL PRODUCE A CUSTOMIZABLE, EXTENDIBLE, FORMALLY-SPECIFIED, INTEGRATED ENVIRONMENT FOR AUTOMATED RE-ENGINEERING AND MAINTENANCE OF ADA. IT WILL ENHANCE THE REUSE AND SEE CAPABILITIES OF THE STARS PROGRAM. AUTOMATICALLY OBJECT-ORIENTING ADA CODE WILL INCREASE THE REUSABILITY OF ADA CODE, AT MINIMAL COST, OTHERWISE THE DOLLAR COST AND COMPLEXITY OF MANUAL REORGANIZATION MAY RENDER THE ADA CODE NOT REUSABLE, LEAVING STARTING FROM SCRATCH AS THE ONLY OPTION. THIS SYSTEM WILL HAVE WIDE APPLICATION IN A MULTITUDE OF OTHER

LANGUAGES AT LITTLE EXTRA COST.

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Topic#: 91-111 ID#: 9121001
Office: DSO
Contract #: DAAH0192CR068
PI: ROBERT HUNTER

Title: BIOMIMETIC PROCESS FOR HAZARDOUS WASTE REMEDIATION

Abstract: BIODEGRADATION OF HAZARDOUS WASTES OF THE TYPES GENERATED BY DOD ACTIVITIES OCCURS IN NATURE IN A VARIETY OF ENVIRONMENTS. THIS PROJECT WILL BUILD ON KNOWLEDGE PRODUCED BY RECENT RESEARCH IN MICROBIOLOGY TO FORMULATE A NOVEL BIOMIMETIC PROCESS FOR HAZARDOUS WASTE REMEDIATION. IT WILL BRING TOGETHER THE STOICHIOMETRIC, ENERGETIC, AND KINETIC DATA REQUIRED TO EVALUATE PROCESS FEASIBILITY FROM A REACTOR ENGINEERING PERSPECTIVE. TRANSFORMATIONS WILL OCCUR FIRST IN A SULFATE-REDUCING ENVIRONMENT, SECOND IN A METHANOGENIC ENVIRONMENT, AND THIRD IN AN AEROBIC ENVIRONMENT. TOXIC ORGANIC COMPOUNDS WILL BE PARTIALLY DEGRADED WITH CONCURRENT METALS PRECIPITATION (AS SULFIDES) AND NEUTRALIZATION DURING SULFATE-REDUCTION. IN THE METHANOGENIC STEP, CONVERSION OF ORGANIC METABOLITES PRODUCED IN THE SULFATE-REDUCTION STEP TO METHANE AND CARBON DIOXIDE WILL OCCUR. POLISHING IN AN AEROBIC ENVIRONMENT MAY ALSO BE REQUIRED. THUS, THE PROCESS WILL MIMIC THE STEPS MICROBIAL COMMUNITIES WOULD TAKE IF OPTIMUM ENVIRONMENTAL CONDITIONS WERE PROVIDED FOR EFFICIENT TRANSFORMATION OF SUCH WASTES. KINETIC CONTROL (CONTROL OF MEAN CELL RESIDENCE TIME) AND/OR SULFATE AVAILABILITY WILL BE USED TO ISOLATE THE SULFATE-REDUCTION STEP. MICRO-ORGANISM SCREENING WILL IDENTIFY THE BIODEGRADATION CAPABILITIES OF SPECIFIC ANAEROBIC MICROORGANISMS AND MIXED CULTURES TO BE USED IN A PROOF-OF-CONCEPT DEMONSTRATION IN PHASE II. THE RESEARCH WILL IDENTIFY BIODEGRADATION OPPORTUNITIES TOR WASTES COMMONLY PRODUCED BY DOD ACTIVITIES, INCLUDING AROMATIC AND HALOGENATED HYDROCARBONS, HEAVY METALS AND SALTS. A FEASIBLE PROCESS WOULD ALSO HAVE CIVILIAN APPLICATIONS.

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Topic#: 91-007
Office: AM
Contract #: DNA91-C-0094
PI: R.G. ROSEMEIER, PHD
ID#: 91DNA-001
Title: Nuclear Hardening and Survivability
Abstract: With the gradual replacement of electronic computational systems for high throughput, extremely fast, optical signal processors (optical computers, correlators, etc.) In the nuclear warfare arena, the need exists to evaluate optical signal processor components in both real and simulated nuclear environments. Since BRIMROSE is one of the world leaders in the optical signal processing components field, it would be appropriate to have our devices evaluated in simulated nuclear environments. In Phase I, BRIMROSE acousto-optic devices, which are presently used in optical computers, early warning radar systems, laser communication systems, etc., will be evaluated before and after nuclear simulation environments. Upon arrangements made by DNA, the Maxwell facility at San Diego will be used. In Phase II, depending upon the results, radiation hardening techniques will be studied and employed to improve the device performance. Should this work become classified, BRIMROSE will be able to participate.

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Phone: (213) 541-2227
Topic#: 91-004
Office: AM
Contract #: DNA91-C-0044
PI: Herman Jerry Carpenter
ID#: 91DNA-020
Title: 8-lb Charge HOB Experiment Report
Abstract: Phase I proposes to gather the data and descriptive information for a 28-shot set of experiments made in the early 1970's to measure high overpressure airblast from 8-lb charges of PBX-9404, to prepare a work plan and procedures for completing the data processing from the experiments, checkout the procedures with sample analyses, and to prepare a cost estimate for Phase II. The completion of Phases I and II will provide a detailed documentation of the test procedures, facility, equipment, and results. The results represent the United States data base for HE height-of-burst overpressure from less than 6 bars to 1 Kbar.

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Topic#: 91-005
Office: AM
Contract #: DNA91-C-0042
PI: Herman Jerry Carpenter
ID#: 91DNA-021
Title: Free-Air Blast Measurements for Cavity UGT
Abstract: A Phase I SBIR study is proposed to determine analytically the feasibility of measuring the free-air (unreflected) airblast waveforms from a nuclear burst in an underground cavity. Such data would be useful for evaluating measurements to be made of the airblast in the region of blast reflection from the cavity floor and wall. The study will consider well-proven piezoelectric and resistive techniques used in above ground HE tests to determine if special shielding provided by the mounting scheme can protect adequately against nuclear radiations. Modifications to these well-developed techniques will be investigated to provide the required protection. If required, some ideas for new approaches using optics will be investigated. The goal of Phase I is to prove analytically the technical feasibility of one or two schemes, to accomplish their preliminary design, and to prepare a plan for experimentally proving them in laboratory tests. Phase I results would support a Phase II effort of detailed probe design, fabrication, proof testing, and possibly fielding in the Diamond Fortune UGT.

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Topic#: 91-007
Office: AM
Contract #: DNA91-C-0106
PI: James D. Klein
ID#: 91DNA-002
Title: Ion Beam Deposited Ferroelectric Memory Films
Abstract: Computer memory arrays are extremely vulnerable to electromagnetic disturbances resulting from accidental or hostile actions. Hardening against such effects can be imparted either by adding external protection to existing systems or by incorporating survivability in new designs. Inherent hardness can be imparted to random access memory arrays by using thin

film ferroelectric materials as memory elements. The development of an optically monitored ion beam technique for the deposition of ferroelectric thin films is proposed. The novel production method will produce in-situ perovskite ferroelectric thin films of the desired chemical composition and crystallographic properties on Si and GaAs semiconductor substrates without post deposition firing and annealing. Specifically, the process is designed to address issues such as cation stoichiometry, phase stability, film/substrate epitaxy, substrate temperature, process fingerprinting, and real-time feedback control. Since the as-deposited ferroelectric films are intended for nonvolatile memory applications, endurance and retention characteristics are extremely important. A more thorough characterization of basic electronic materials properties is proposed in addition to the usual ferroelectric behavior and memory retention trials. The implementation of real-time feedback control, extension to other ferroelectric systems, scale-up to production technology, and integration in active arrays would be addressed in the phase II program.

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Topic#: 91-005
Office: AM
Contract #: DNA91-C-0102
PI: Bruce N. Nelson

ID#: 91DNA-003

Title: Ruby Stress and Pressure Measurement Systems for Broadband UGT Measurement Applications

Abstract: Ruby stress pressure measurement systems will offer significant advantages to the requirements of underground testing. Ruby stress and pressure measurement systems offer sensing ranges as large as 125 kbar and sub-nanosecond rise time capability. This results in these sensors being especially suited to the requirements of close in pressure and stress measurements. To date systems based on this technique have not been developed for field use. The proposed program addresses the development of ruby stress and pressure measurement systems for both underground and above ground tests. In the proposed program the requirements for ruby stress and pressure sensors to support these tests will be assessed. The ruby measurement technology developed at Washington State University will be transferred to GEO-CENTERS. A conceptual design for fieldworthy measurement systems will be developed. Additionally, an above ground simulation test program to validate the use of this measurement technology on UGT's will be developed in the Phase I program.

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Topic#: 91-005
Office: AM
Contract #: DNA91-C-0128
PI: Bruce N. Nelson

ID#: 91DNA-004

Title: High Frequency Airblast Pressure Sensor for UGT Measurements

Abstract: Conventional instrumentation for airblast pressure measurements in cavity shots is limited in rise time capability. This results in the instrumentation providing an incorrect indication of peak pressure, which creates distortion in generated height-of-burst curves. The development of a fiber optic airblast pressure sensor based on the photoelastic effect is proposed. This technique promises to provide airblast pressure sensors with peak pressure measurement capability to as high as 20 kbar with a sub-microsecond rise time capability. This would offer a significant improvement to airblast pressure measurements on cavity shots. The proposed measurement technique has been successfully utilized on Underground Tests. On DISKO ELM the output detection scheme that will be used with these sensors demonstrated the measurement capabilities that will be achieved in the airblast pressure sensors.

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Topic#: 91-007
Office: AM
Contract #: DNA91-C-0107
PI: Bernhard Cordts

ID#: 91DNA-005

Title: Development of a Depth Profiling Method For Use With A Total Reflectance X-RAY Fluorescence System

Abstract: SIMOX material is rapidly becoming the SOI material of choice for many IC applications, including radiation hardened. A constant theme of concern throughout the development of this technology has been the metallic impurity content in the material. Major efforts have addressed the elimination of the metallic contamination by modification of the implantation equipment used to fabricate SIMOX material, with recent material having contamination levels at the detection limits of SIMS. However, a new contamination measurement technology has become available; Total Reflectance X-ray Florescence (TXRF).

This measurement system is much more sensitive than SIMS at detecting contamination on the surface of a silicon wafer. However, to be most useful for SIMOX, the technology must be developed to allow for contamination profiling in-depth into a SIMOX wafer. Two methods are proposed for obtaining this depth information: a modification of the measurement technology (increase angle of incidence) and etching or oxidizing the SIMOX wafer to expose the lower silicon layers at the surface.

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Topic#: 91-007
Office: AM
Contract #: DNA91-C-0108
PI: Dr. Eduardo Saravia
ID#: 91DNA-006

Title: Californium-252 System for Single Event Upset Testing of Microelectronics.

Abstract: Advances in electronic device technology have led to increased packing densities while power consumption has dropped. In general, this trend is beneficial to avionics and space applications except that a new failure mode has accompanied this miniaturization. In high energy particle environments, such as encountered in space, microelectronic devices have been shown to be susceptible to transient or permanent failures called single event upsets (SEU). To qualify and design microelectronic components against SEU's, there is the need for a small, low cost single event upset testing system as a supplement or alternative to accelerator and high-altitude or space testing facilities. The approach proposed in this document is based on the demonstrated capability of Californium-252 system to measure the SEU cross section for microelectronic devices. The main advantages of this technique are that it is simple, accurate, compact and essentially real time. However, to develop a SEU testing system for state-of-the-art microelectronic devices for commercial applications in the semiconductor manufacturing industry, significant improvements of present experimental facilities must be incorporated into a more advanced system. The proposed Phase I effort is to design a fully computerized system based on Californium-252 source to test microelectronic devices against SEU's.

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Topic#: 91-015
Office: AM
Contract #: DNA001-91-C-0080
PI: Dr. John R. Bayless
ID#: 91DNA-018

Title: Radiation-Processed High-Energy-Density Capacitor Development

Abstract: The availability of energy storage capacitors with high energy densities ($>>1$ kJ/kg) is critical for many pulsed power applications. Conventional capacitor designs, as well as those currently being developed, use laminated assemblies which are impregnated with liquid dielectrics. However, since the dielectric strength of liquid is generally much less than for solids, the maximum operating electric field is limited by the impregnant. This, in turn, limits the energy density that is attainable. The objective of the Phase I project is to determine the technical feasibility of impregnating high energy density capacitors with liquid monomers which are then polymerized (solidified) by exposure to electron or x-ray radiation at doses of 1-10 megarads. The use of elastic, radiation-cured, polymer impregnants is expected to offer many advantages over other possible solid impregnation approaches. The proposed Phase I tasks are to: (1) screen and select candidate liquid monomers; (2) construct an experimental system for processing and testing small ($\sim$25 cm2) sample capacitor sections and (3) demonstrate that dielectric strengths (>10 kV/mil), dielectric constants ($k>5$) and other properties of radiation-cured dielectric materials can be achieved which are suitable for advanced capacitor applications. The participation of a highly qualified polymer chemist, a major capacitor manufacturer and three material manufacturers will help to insure that Phase I is successful and that if forms a firm foundation for development of prototype capacitor units in Phase II.

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Topic#: 91-005
Office: AM
Contract #: DNA91-C-0086
PI: H. Jake Tausch
ID#: 91DNA-007

Title: Instrumentation-Development of Portable Memory Radiation Effects Tester

Abstract: Under this effort, we will develop a portable memory tester uniquely designed to perform the types of tests required for radiation effects characterization. Specifically, it will perform tests to characterize single event Phenomena (SEP), Total

dose ionizing effects, dose rate, and rapid annealing phenomena. It will combine key features of general purpose ASIC testers and dedicated memory testers required for these types of tests.

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Topic#: 91-001 ID#: 91DNA-008
Office: AM
Contract #: DNA91-C-0123
PI: Clayton R. Morlock

Title: 3-D Animation of Nuclear Weapons Effects Calculations

Abstract: A demonstration will be performed that will show the utility of real time animation of nuclear weapons effects data. Data depicting the propagation of an airblast, ground shock and crater formation will be simultaneously animated on a 3-D graphics workstation. Recent advantages in computing have made it possible to render 3-D shaded images of polygon data at incredible speeds. By using existing software and a custom software interface,it will be possible to display these three data sets as shaded surfaces simultaneously and watch them expand with time. Visualization will be further enhanced by interactive manipulation of the viewing angle and position, and illumination of these surfaces. Clipping of the data set will allow observation of the of the internal structure of the expanding blast front. Utilizing transparency functions applied to the airblast will further enhance visualization of the crater formation.

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Topic#: 91-001 ID#: 91DNA-012
Office: AM
Contract #: DNA91-C-0124
PI: Dr. Harold L. Brode

Title: The Physics of Wave Generation From Bursts At the Upper Critical Depth

Abstract: Detonation of explosives at the upper critical depth (UCD) can generate water surface waves at great distances that are more than twice those from a deeper detonation. Evidence for the UCD phenomenon is entirely empirical. The proposed research will expand on an innovative physical explanation of the UCD, and will provide quantitative predictions in support of a corresponding UCD for nuclear explosions (NUCD). A unique calculational program will be formulated whose objective is to model the interaction between water motion and air blast from partially submerged HE charges and shallowly submerged nuclear warheads. We hypothesize the existence of a NUCD which could be of great importance for both offensive and defensive considerations, making more practical the threat of widespread damage to ships and submarines in shallow water and extensive destruction in harbors and shoreline installations. The overall objective is to answer the question: 1. What physics is important to the UCD, and why is the maximum so sharp? 2. Does the same physics apply for a NUCD; if so, at what depth? 3. Can the UCD or NUCD phenomena be enhanced by using multiple explosives, e.g , simultaneous explosions of a small yield above and a larger yield below the surface?

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Contract #: DNA91-C-0142
PI: John D. German

Title: The Effectiveness and Feasibility of Low Energy Lasers in Nuclear Weapons Security

Abstract: Low-Energy laser technology has the potential to significantly improve the efficiency and effectiveness of nuclear weapons security operations. Such lasers, employed in either automated or remotely manned configurations, can supplement current physical security measures by providing three non-lethal response options: (1) warn intruders that they have been detected and are entering a secure area, (2) impede the advance of intruders who do not respond to the initial warning, and (3) impair the ability of intruders to function effectively. Low Energy laser interactions with intruders' eyes ranging from harmless glare and flashblinding to retinal hemorrhage with minimal residual damage, can warn intruders, delay their advance through discomfort and visual interference, and limit their ability to perform visual tasks such as aiming a gun or breaking into a weapon storage building. In the proposed Phase I effort, Science and Engineering Associates, Inc. will evaluate the potential effectiveness of employing low-energy lasers to enhance nuclear weapons security operations and determine the capability of current laser technology to provide the necessary hardware. These results will provide the basis for deciding whether to proceed with the development and field testing of a laser security system prototype under Phase II.

SCIENCE RESEARCH LABORATORY, INC.
15 WARD STREET
SOMERVILLE, MA 02143
Phone: (617) 547-1122
Topic#: 91-016 ID#: 91DNA-011
Office: AM
Contract #: DNA91-C-0114
PI: Dr. Mahadevan Krishnan
Title: Higher Efficiency X-Ray Load Designs for Z-Pinch Implosions
Abstract: It is proposed to design a set of novel load geometrics for high current z-pinches. These geometrics could lead to significant improvements in the flash x-ray capabilities of existing of existing nuclear weapons effects simulators, for both soft x-rays (1-5 keV) and warm x-rays (5-15keV). Most existing weapons effects x-rays sources implode simple, annular wire-arrays or supersonic gas puffs to produce z-pinches that emit x-ray bursts. More complex load configurations, such as nested wire -arrays or a gas puff imploding onto an inner wire array, could tailor the implosion to increase the K-shell fraction of the total x-ray yield, although the total energy coupled from driver to load remains the same. It is proposed to study several candidate nested arrays to select promising configurations for high current tests during Phase II.

SYSTEMS CONTROL TECHNOLOGY, INC.
2300 GENG ROAD
PALO ALTO, CA 94303
Phone: (415) 494-2233
Topic#: 91-010 ID#: 91DNA-013
Office: AM
Contract #: DNA91-C-0087
PI: Larry P. Cady
Title: The Use of AI Technology to Exploit Operational Planning and Tactical Intelligence Systems
Abstract: This proposal addresses the operational planning and targeting problems of a commander in a tactical or mixed tactical/nuclear theater. In such a theater, both the friendly and enemy forces will possess highly mobil weapons systems. In order to use his weapons effectively, the operational commander must be able to track, target, and strike the enemy's moving forces. Sophisticated intelligence gathering systems are now available which can track moving targets. Similarly, sophisticated automated planning aids are also available which can help the commander's staff plan nuclear strikes and predict Pk. Unfortunately, it is very difficult to use the available near real-time intelligence data to do operational planning. SCT is proposing to develop an AI-based "Intelligent Interface" which will be capable of automatically identifying candidate targets from an operational intelligence system. The system will also supply necessary nuclear weaponeering data and reformat the data for input to an operational nuclear planning system. The Intelligent Interface will base its decisions on a rule base, data on the commander's targeting guidance, and operator inputs. During Phase I, the concept will be developed to establish technical feasibility. This effort will lay the groundwork for development of an operational prototype.

TERRA TEK, INC.
UNIVERSITY RESEARCH PARK, 400 WAKARA WAY
SALT LAKE CITY, UT 84108
Phone: (801) 584-2475
Topic#: 91-011 ID#: 91DNA-014
Office: AM
Contract #: DNA91-C-0143
PI: Dr. Conrad W. Felice
Title: Development of a Residual In-Situ Stress Gauge
Abstract: Quantitative verification of the residual in-situ stress field which creates the containment cage is needed to assess the factor of safety against hydraulic fracturing from the cavity wall. Phase I will establish the feasibility of developing a passive stress gauge, absent of active instrumentation, and capable of recording the residual in-situ stress field immediately following the nuclear device detonation for a duration of a few minutes. The gauge components will be fabricated and extensively tested under simulated test conditions. The gauge will then be assembled and verified as a whole under simulated test conditions. This will lay the basis for a Phase II effort which would consist of building several gauges for deployment in a nuclear test at the Nevada Test Site.

TERRA TEK, INC.
UNIVERSITY RESEARCH PARK, 400 WAKARA WAY
SALT LAKE CITY, UT 84108
Phone: (801) 584-2475
Topic#: 91-020 ID#: 91DNA-015
Office: AM
Contract #: DNA91-C-0120
PI: Dr. Conrad W. Felice
Title: Dynamic Response of Piles in Saturated Soil
Abstract: The proposed research program will study soil-pile foundation interaction induced by the detonation of conventional

weapons. The ultimate goal of the program is to establish a set of general guidelines for foundation design of future strategic structures as well as the assessment of the vulnerability of existing structures. The Phase I effort will involve analysis of the existing experimental data, conducted under 1 g and 60 g (centrifuge) conditions, in order to construct a set of dynamic P-Y curves which would define the soil-pile interaction. Furthermore, these curves will be used for calculation of the model responses and comparison with experimental data in an effort to establish the feasibility of the proposed technique. Finally, a comprehensive test plan will be developed which will provide the basis for a Phase II research program and ultimate development of design guidelines for pile foundations.

TETRA CORP.
3701 HAWKINS STREET, NE
ALBUQUERQUE, NM 87109
Phone: (505) 345-8623
Topic#: 91-015 ID#: 91DNA-016
Office: AM
Contract #: DNA91-C-0101
PI: Chris M. Young
Title: Advanced High Power Switching Technology
Abstract: Future systems employing pulsed power technology will require significant improvement in the current state of the art of pulsed power devices. In particular, high voltage repetitive switches are needed which significantly go beyond the present capabilities of known switches. Future switching technology needs to handle voltages ranging from hundreds of kilovolts to megavolts, hundreds of kiloamperes to megaamperes, and repetition rates up to 100 kilohertz. The switching technology of the future must satisfy these conditions as well as have low timing jitter, low switching delays, have long lifetimes, operate at elevated temperatures, and have low losses. We propose a new switch technology which offers scalability to all of the above requirements. We propose to design, fabricate, and test our proposed switch in this Phase I effort. The objective will be to demonstrate the feasibility of the concept and provide a basis for a Phase II optimization and characterization program.

UNISTRY ASSOCIATES
PO BOX 421
SOUTHEASTERN, PA 19399
Phone: (215) 964-1909
Topic#: 91-001 ID#: 91DNA-017
Office: AM
Contract #: DNA91-C-0125
PI: Dr. Anthony L. Laganelli
Title: Nuclear Weapon Effects Calculation
Abstract: A research program is proposed to reduce uncertainty factors in mass loss ratio, "G lay", correlations that are currently used in material response codes for predicting fratricide effects on strategic weapon systems. Mass loss ratio is defined as the ratio of the mass flux of eroded nosetip divided by the mass flux of incoming particles from an erosive environment. Recent DNA sponsored programs have identified "G law" uncertaintics, which have been quantified as a factor of two, and an important criteria in the consideration in planning targeting and strike timing. The following program proposes to apply and refine new transient debris shielding models to existing ballistic range data and flight data. At the time these data were obtained, debris shielding models and the intervals between particle discrete fields (transient effects) in ballistic ranges were not understood or incorporated into mass loss correlations. Re-examination of this existing database together with improved modeling from current DNA programs to include transient debris shielding with coupled effects modeling should enable improvements to the basic "G laws" models. This work can lead to improved test diagnostics and a limited test program to validate the models in a Phase II program.

VACTRONIC LAB EQUIPMENT, INC.
160 WILBUR PLACE
BOHEMIA, NY 11716
Phone: (516) 567-0520
Topic#: 91-014 ID#: 91DNA-019
Office: AM
Contract #: DNA001-91-C-0079
PI: David G. Jeng
Title: Extrinsic Photoconductivity Switches Using CVD Diamond
Abstract: Extrinsic Photoconductivity Semiconductor Switches (PCSS) based on CVD diamond-film (DF) has been developed. Diamond material possesses several advantages such as high thermal conductivity and high breakdown voltages. The PCSS based on CVD diamond can be superior than its counterparts (GaAs or Si) by exploiting these advantages. Conventional PCSS's based on GaAs suffer from problems such as thermal runaway; while that same devices based on silicon encounter the difficulties such as speed limitation. In great contrast, diamond-based PCSS's are free from these shortcomings. The only problem that diamond PCSS may encounter is the lacking of suitable light sources for its intrinsic type photoexcitation. Short-wavelength light

pulses are required in carrier excitations of the 5.5 electron volts (eV) energy bandgap for intrinsic diamond. The development of the extrinsic diamond PCSS's, which operate in the visible spectrum, has greatly simplified this problem and provided for photoconductivity applications in the IR to visible range.

VIRTUAL IMAGE LABS, INC.
4925 EDGEWOOD ROAD
COLLEGE PARK, MD 20740
Phone: (301) 776-0280

Topic#: 91-001 ID#: 91DNA-009
Office: AM
Contract #: DNA91-C-0124
PI: Ernest T. Wright III

Title: Microcomputer Visualization of Nuclear Cloud Models

Abstract: The proposed effort will seek to demonstrate the utility of microcomputer visualization as an effective and low-cost validation, diagnostic and presentation tool for 3d models.The approach will be tested using TASS 3D cloud simulation output, but the methods developed will be applicable to a wide variety of 3D models. In Phase I, the proposer will (1) choose the technology for handling the transfer of the cloud data onto microcomputer storage media, (2) develop and refine a computer program for building geometric descriptions of 3D boundaries which enclose a desired volume, and (3) use existing microcomputer graphics programs and the transformed simulation data to produce still images and animations of a nuclear cloud model. The innovative heart of the approach is the custom software of step (2). This program will form a bridge between 3D models and powerful microcomputer graphics technology, making 3D model images available on micro displays, videotape, slides and prints, media which are inexpensive and accessible to a wide audience.

ADROIT SYSTEMS, INC.
809 NORTH ROYAL STREET
ALEXANDRIA, VA 22314
Phone: (703) 684-2900
Topic#: 91-001 ID#: 91-500
Office: SDC
Contract #: DASG60-91-C-0066
PI: Richard D. Jurgens
Title: Global Positioning System Attitude Control
Abstract: A prototype guidance and control system sensor for Directed Energy Weapons is proposed. This guidance subsystem sensor will use the Global Positioning System (GPS) satellite constellation for both position and attitude determination of the DEW. This GPS attitude determination system can be can be applied for pointing and attitude control of many types of DEWs, including ground, air, and space based weapons. An Adroit conceived innovative algorithm called the Error Correcting Attitude Solution (ECAS) is proposed to calculate the attitude solution. The ECAS should greatly enhance the performance and applicability of the GPS and ADS. The ECAS will allow for correction of the two largest error sources: unmatched antenna phase difference error and electrical path length bias and variation. These corrections can greatly increase the accuracy of the ADS, while also increasing the mounting environment tolerance of the antenna system. This should make the ECAS ADS an ideal guidance sensor for DEWs. Phase II of this project will be to implement the ECAS in an operational ADS.

ADVANCED DEVICE TECHNOLOGY, INC.
3 BUDWAY, UNIT 29
NASHUA, NH 03063
Phone: (603) 886-4943
Topic#: 91-003 ID#: 91-063
Office: AF
Contract #: F29601-91-C-0066
PI: Dr. Peter J. Kannam
Title: 128x128 Element Monolithic Dual Band HgCdTE Staring Arrays
Abstract: Missile seekers must detect targets in dual bands (3-5 um and 8-12 um). They now use hybrid assembly of two separate arrays, which increases the power, consumption, the weight, and the cost. We will develop monolithic dual band 128x128 staring arrays on HgCdTe material. The innovation is the detection of both long and short wave signals in the same pixel simultaneously. Fabrication methods are developed to achieve pixel co-location. The methods are such that crosstalk among adjacent diodes and between wave bands are eliminated. Circuits are designed to perform simultaneous detection in two wave bands. A new MOCVD epitaxial growth by photochemical technique (200C growth) is initiated (reactor 1). Dual band wafers and p-n junctions are already grown in a standard MOCVD reactor (reactor 2). These structures are grown with a wide band-gap cap layer to improve performance. A new multi-layer metal scheme is developed to improve reliability. A set of masks for 4x4 element test arrays are designed and all mask levels are obtained.

ADVANCED FUEL RESEARCH, INC.
PO BOX 380343
EAST HARTFORD, CT 06138
Phone: (203) 528-9806
Topic#: 91-014 ID#: 91-380
Office: ONR
Contract #: N00014-91-C-0101
PI: Philip W. Morrison, Jr.
Title: Epitaxial Growth of Single Crystal Diamond on Silicon
Abstract: Nucleation remains an obstacle to the growth of single crystal films of diamond on non-diamond substrates. Two key factors control the nucleation of diamond on Si: the formation of a SiC layer between the Si and the film, and spontaneous nucleation of the SiC on the contaminated Si surface. Imprecise control of the nucleated SiC layer has defeated previous attempts at heteroepitaxy of diamond on Si. This research will use a spin etch method to reduce the C and O contaminations on the Si surface to < 0.05 monolayer. Scrubbing of reactant gases will reduce O2 and H2O to < 10 ppb and prevent recontamination of the deposition. Careful preparation of the Si surface should cause the SiC layer to nucleate epitaxially on the Si and as a single crystal. If necessary, we will use laser ablation to tailor the composition of the SiC to enhance heteroepitaxy or deposit other buffer layers. Given a single crystal buffer layer, the nucleation of a single crystal diamond film should be straightforward.

ADVANCED FUEL RESEARCH, INC.
PO BOX 380343
EAST HARTFORD, CT 06108
Phone: (203) 528-9806
Topic#: 91-015 ID#: 91-402
Office: AF
Contract #: F49620-91-C-0067
PI: David Fenner
Title: Superconducting Flux-Coupled Fast Switching Device from YBCO Films on Silicon

Abstract: Applications of high-temperature superconducting materials to tunneling devices have been limited by fabrication problems related to the intrinsic anisotropy of these materials, to their extremely short superconducting coherence length, and to the poor electrical properties of the native surface oxide on the YBa2CuO7-x (YBCO) family of HTSC materials. Magnetic flux-coupled switching devices may be less limited by the problems just described. The innovation for this proposal is to demonstrate a flux-coupled switching device using two recent advanced by the Principal Investigator. It is proposed here to demonstrate a particular design for a flux-coupled thin-film switching device utilizing the new pulsed-laser deposition synthesis route to epitaxial, high critical-current YBCO films on YSZ-buffered silicon substrates. The use of Si wafers as substrates will not only allow very high quality films but also many new design configurations employing HTSC switching devices useful from DC to microwave. In particular, we will first form simple contact bonded pairs of film-coated Si wafers and evaluate their flux coupling properties, and then passivate the YBCO film surfaces and bond pairs of these wafers with polymer adhesives.

ADVANCED SCIENTIFIC CONCEPTS, INC.
2441 POOTHILL LANE
SANTA BARBARA, CA 93105
Phone: (805) 966-3331
Topic#: 91-003 ID#: 91-123
Office: SDC
Contract #: DASG60-91-C-0081
PI: Dr. Roger Stettner
Title: A Solid-State Visible and Infrared Multiplier
Abstract: The Solid-state Visible and Infrared Multiplier (SVIRM) detector will amplify the signal from a single visible or infrared photon, above readout noise, with low dark-current, making the photon detectable. The SVIRM uses a novel silicon structure. The advantages over contemporary state detectors are orders of magnitude less noise; orders of magnitude lower dark current; compatibility with silicon, sense-capacitor readout arrays; and good responsivity uniformity which is compatible with staring array configurations. The MWIR/VLWIR-SVIRM largest dynamic band reaches over 10E14 ph/cmE2-sec. SVIRM will be a practical device for detector infrared detectors. There is no comparable, array-compatible, MWIR/VLWIR detector available for use at very low photon fluxes, where single photon detection is desirable, as well as for use at the higher photon fluxes possible in near target encounters and higher background scenarios.

ADVANCED TECHNOLOGY MATERIALS, INC.
520-B DANBURY ROAD
DANBURY, CT 06776
Phone: (203) 355-2681
Topic#: 91-014 ID#: 91-479
Office: SDC
Contract #: DASG60-91-C-0061
PI: Charles P. Beetz, Jr.
Title: Bulk Growth of SiC Single Crystals
Abstract: The next generation of high power, high frequency electronic device technology will be based on wide bandgap semiconductor materials such as SiC, GaN and diamond. Of these, silicon carbide is the most promising material for near term applications, since its processing shares many common features with well-established silicon processing. Technology has been demonstrated for producing ohmic and Schottky contacts, shallow dopants are available for both p and n type materials, and p-n junctions are readily fabricated. A major deficiency that is presently limiting the acceptability of SiC as a serious material system for high temperature, high power electronic applications is the lack of a commercially available source of semiconductor grade SiC wafers. ATM proposes a commercially viable approach for the growth of bulk single crystal 6H-SiC ingots. The proposed technology development uses several innovative approaches to control the rate of sublimation of SiC from a solid source rod and to seed the crystal growth.

ADVANCED TECHNOLOGY MATERIALS, INC.
520-B DANBURY ROAD
DANBURY, CT 06776
Phone: (203) 355-2681
Topic#: 91-014 ID#: 91-551
Office: ONR
Contract #: N00014-91-C-0096
PI: Duncan W. Brown
Title: Single Molecule Source Reagents for CVD of Beta Silicon Carbide
Abstract: High power and high temperature electronic devices are important in both defense and commercial systems. Beta silicon carbide is an excellent candidate semiconductor material for demanding applications due to its high breakdown voltage, relatively large band gap, high thermal conductivity and high melting point. Use of silicon carbide thin films is hampered, however, by the inability to reproducibly grow stoichiometric films free from excess silicon or carbon. Single molecule source reagents, introducing equivalent amounts of reactive silicon and carbon, are proposed for MOCVD of stoichiometric beta silicon

carbide. In Phase I sources will be synthesized, their decomposition pathways studied, and their use for the CVD of beta growth conditions will be optimized and the focus will shift towards the synthesis of an ultrahigh purity, unimolecular source and the growth of intrinsic Beta-SiC for device applications.

ADVANCED TECHNOLOGY MATERIALS, INC.
520-B DANBURY ROAD
DANBURY, CT 06776
Phone: (203) 355-2681
Topic#: 91-014 ID#: 91-567
Office: DNA
Contract #: DNA001-91-C-0078
PI: Peter S. Kirlin
Title: BaTiO3 - SrTiO3 DRAMs
Abstract: Exploitation in microelectronics of the very high dielectric constants of ferroelectric perovskites such as BaTiO3 and PZT has been limited by materials processing and compatibility problems. High quality ferroelectric thin films have not been grown at temperatures compatible with standard Si or GaAs processing technologies. A huge payoff awaits one who can unlock the potential of ferroelectric perovskites for use in the production of low cost DRAMs. Growth techniques compatible with silicon processing developed at ATM for the high temperature superconductors will be applied to the deposition of Ba1-xSrxTiO3. BST has been selected for development for DRAM applications because systematic variation of the Ba/Sr ratio offers excellent control over the modulation of the dielectric constant (500-1500) and conduction properties of the ferroelectric films. The specific goal of the Phase I program is to deposit oriented Ba1-xSrxTiO3 thin films on Si(100) at temperatures below 650 degrees by PE-MOCVD. A prototype DRAM based on Ba1-xSrxTiO3 capacitor storage cells will be fabricated and tested in Phase II.

AERODYNE RESEARCH, INC.
45 MANNING ROAD
BILLERICA, MA 01821
Phone: (508) 663-9500
Topic#: 91-014 ID#: 91-032
Office: ONR
Contract #: N00014-91-C-0103
PI: Dr. Andrew Freedman
Title: *Atomic Layer Epitaxy of Diamond Films*
Abstract: We are developing a molecular beam epitaxy approach to grow epitaxial diamond thin films for electronic devices. With halogen atoms and halocarbon free radicals to control the deposition we will overcome the propensity of typical diamond deposition processes to grow 3-dimensional micro-crystalline films. If this project succeeds, we will develop a high-speed and/or high power electronic device technology from diamond films.

AEROSPACE DESIGN & DEVELOPMENT, INC.
PO BOX 672
NIWOT, CO 80544
Phone: (303) 530-2888
Topic#: 91-003 ID#: 91-452
Office: AF
Contract #: F29601-91-C-0064
PI: H.L. Gier
Title: A High Reliability Oxygen/JTX Cryogenic Refrigerator
Abstract: Using technology now in existence and now being developed it is possible to build a high reliability, cryogenic oxygen refrigerator. The temperature range in which the refrigerator would function would be controllable between 70 and 140 Kelvin. The basis for this refrigeration cycle would be ceramic electrolyte technology by which oxygen can be compressed using an electric potential across the ceramic. No moving parts are required in the compressor which leads to the reliability of the refrigerator. Following the compression, the refrigerator would consist of heat exchangers and a Joule-Thomson expander valve. This refrigeration cycle also has no moving parts and is extremely reliable. The whole system will be almost as reliable as the electric power source required for its operation. Phase I of the effort will investigate the characteristics of the ceramic electrolytic oxygen refrigerator, and the power requirements, any failure modes, and the coefficient of performance for the system parametrically. Phase II will design, produce, and test an experimental refrigerator. Phase III would produce an operation CEOR for sensor cooling.

AMERICAN RESEARCH CORP. OF VIRGINIA
PO BOX 3406
RADFORD, VA 24143
Topic#: 91-002 ID#: 91-319
Office: SDC
Contract #: DASG60-91-C-0089

Phone: (703) 731-0655 PI: M.G. Niimura
Title: Measuring Magnetic Field Structure Behind a Projectile
Abstract: DMS (Diluted Magnetic Semiconductor) crystal will measure magnetic field strengths of a Hypervelocity Gun (HVG), with uniquely high directivity and spatial resolution, under a harsh Electro-Magnetic Interference (EMI) condition. Knowledge of the magnetic field structure behind and ahead of a projectile is essential for designing an efficient HVG of SDI interest, although EMI makes such a measurement often unreliable with conventional magnetic pickup probes. A novel M-O crystal was used for solving the problems. The EMI would not increase the frequency due to the flat response to ~1GHz. The directivity and spatial resolution is as good as those of probing laser beam. The Phase I Report has presented physics of the giant Faraday effect of DMS and experimental verifications/demonstration of the basic M-O effects, linearity against DC field strengths, Verdet constant 580 times greater than quartz for a Cd(1-x)Mn(x)Te, x=0.45 sample, high frequency response, simple polarimeter based on the intensity method, and sensor system with a 6.75kJ HVG.

APA OPTICS, INC. Topic#: 91-011 ID#: 91-348
2950 NE 84TH LANE Office: NSWC
BLAINE, MN 55434 Contract #: N60921-91-C-0184
Phone: (612) 784-4995 PI: Dr. M. Asif Khan
Title: Vertical Cavity Surface Emitting Laser Modules for Optical Communication and Signal Processing
Abstract: Vertical cavity surface emitting lasers are under development at several U.S. labs which consist of a GaAs/AlGaAs quantum well Fabry-Perot cavity sandwiched between n and p doped high reflectivity semiconductor mirrors (GaAs/AlGaAs quarter wave stacks). Our Phase I research proves the feasibility of unique approach to the electric addressability of these surface emitting lasers. For addressing a (mxn) SEL matrix our approach reduces the pinout number to (m+n). We therefore provide the key innovation needed for practical applications of SEL matrices with pixel densities in excess of 1000, in diverse areas such as optical communications, laser displays, computer graphics and spatial light modulators. A 3x3 matrix addressable SEL device was formed in the Phase I to serve as a proof of concept. In Phase II we will fabricate and package much larger matrices (100x100) with integrated photodetectors and test market them.

APPLIED SCIENCES, INC. Topic#: 91-004 ID#: 91-194
800 LIVERMORE STREET Office: AF
YELLOW SPRINGS, OH 45387 Contract #: F29601-91-C-0070
Phone: (513) 767-1477 PI: Elliot B. Kennel
Title: Rydberg State Enhancement of Thermionic Emission
Abstract: High current and efficiency result from using graphite or diamond cathode materials, according to research performed at Applied Sciences, Inc. Why? Nobody knows! Elliot Kennel of ASI says that the results may be due to Rydberg excited states cesium atoms produced in the plasma space between electrodes. The Rydbergs are produced from contact between cesium and some forms of carbon. If this is so, high power plasma switches and/or more efficient thermal-to-electric energy converters will result. Phase I will explain why the "Rydberg converter" gives more than twice as much bang per buck than conventional name brands, and Phase II will exploit the band in an operating device--either a converter or a high power switch (haven't decided yet which).

APPLIED SCIENCES, INC. Topic#: 91-013 ID#: 91-169
800 LIVERMORE STREET Office: SDC
YELLOW SPRINGS, OH 45387 Contract #: DASG60-91-C=0100
Phone: (513) 767-1477 PI: Max L. Lake
Title: Diamond Fibers for Heat Sinks*Diamond Fibers for Thermal Energy Management
Abstract: Diamond fiber, when a highly-graphitic core fiber of 1 to 5 microns has a diamond coating of 2 to 10 microns, is a hybrid fiber with predominately diamond properties. This enables tailoring of fiber coefficients of thermal conductivity (CTE) to allow matching to the CTE of devices mounted on a composite fabricated from such fibers. Thermal conductivity of the polycrystalline fibers is expected to be isotropic, at 600 W/m-K. As suggested by experiments 20 years ago, a VLS process utilizing 1990 technology for CVD diamond production, coupled with a VLLS method for vapor groan carbon fiber technology can produce whiskers with morphology like diamond whiskers. EDAX shows these fibers to be pure carbon. If confirmed to

be single crystal diamond, this fiber could be useful in radiation-hard fiber optics as well as a composite reinforcement with isotropic thermal conductivity in excess of 2000 w/m-K, and a CTE similar to silicon.

ASTROPOWER, INC.
30 LOVETT AVENUE
NEWARK, DE 19711
Phone: (302) 366-0400
Topic#: 91-005 ID#: 91-218
Office: SDC
Contract #: DASG60-91-C-0072
PI: James A. Rand
Title: Thin Crystalline Silicon Film Photovoltaic Solar Cells and Arrays on Flexible Substrates
Abstract: Solar cells are being fabricated using thin films of silicon on inexpensive, flexible cloth substrates. Photovoltaic devices fabricated with these structures can demonstrate the high performance of crystalline silicon with the light weight of thin film solar cells. The result is a solar cell that has applications wherever a lightweight power source is needed. The radiation tolerance of thin crystalline silicon devices make this technology well suited to space applications. Terrestrial applications can also benefit from the lightweight, low-cost design. All types of mobile power generators, including military and commercial, are potential candidates for this new technology.

AUTONOMOUS TECHNOLOGIES CORP.
520 N. SEMORAN BLVD., SUITE 180
ORLANDO, FL 32807
Phone: (407) 282-1262
Topic#: 91-003 ID#: 91-369
Office: SDC
Contract #: DASG60-91-C-0065
PI: R. Frey
Title: Coherent Laser Radar Monopulse Tracker
Abstract: Autonomous Technologies Corporation is developing a technique for making highly accurate angle measurements using a new approach to processing monopulse heterodyne laser radar signals. The advantage over current monopulse signal processing concepts is that the effects of laser speckle are decoupled from the angle measurement. Phase I consisted of both analysis and simulation which produced a foundation of understanding for Phase II. The angle estimation algorithm which is being developed, based on measurements to be conducted during Phase II, will process both the relative amplitude and relative phase of the return signal for adjacent detector channels. The technology which is being developed may be applied to applications as diverse as strategic target weapons system fire control and tracking the random, involuntary motions of eyes for examination and surgical applications.

BOULDER NONLINEAR SYSTEMS, INC.
2000 5TH STREET, UNIT B
BOULDER, CO 80302
Phone: (303) 670-6116
Topic#: 91-003 ID#: 91-124
Office: AF
Contract #: F33615-91-C-1741
PI: Gary D. Sharp
Title: VLSI-FLC Laser-Beam Steering Device
Abstract: A novel liquid crystal beam is proposed. The active material produces analog phase modulation (nearly 2 pi) with a sub-micron layer, switching at microseconds. To achieve large steer angles and high diffraction efficiency, high spatial frequency structures with analog phase are required. The nematic materials currently used for such devices exhibit slow response times, and limited resolution. While the switching speeds and layer thickness of SSFLC's have attracted attention for agile beam steerers, they have largely been dismissed due to the intrinsic lack of analog phase. The BNS technique solves this problem, producing analog phase with a large dynamic range. Phase I research involves measuring the Modulation Transfer Function (MTF) of the material, using a chirped electrode pattern. A single pixel analog phase modulator is also demonstrated. A preliminary study of VLSI capabilities for addressing a laser beam steerer is performed.

CAPE COD RESEARCH, INC.
PO BOX 600
BUZZARDS BAY, MA 02532
Phone: (508) 759-5911
Topic#: 91-015 ID#: 91-014
Office: SDC
Contract #: DASG60-91-C-0086
PI: R. Scott Morris
Title: Microwave Heating for Processing Ceramic High Tc Superconductors
Abstract: The Phase I effort has successfully demonstrated that combining sol-gel chemistry with microwave heating can result

in the fabrication of a ceramic High Tc Superconductor (HTS) in about an hour. Sol-gel processing resulted in uniform micron-sized precursor powders with the desired stoichiometry. This powder was subsequently heated for 70 minutes under specific conditions in a modified microwave oven thereby producing a black ceramic product. The product exhibited a strong Meissner effect in liquid nitrogen and EDS and back-scattered electron analysis of the surface of the product revealed uniform composition with an empirical formula of YBaE2CuE3OE7. This result represents the fastest successful fabrication of a HTS material to date and holds promise for lower the cost and improving the quality of HTS materials such as high Jc wire.

CHIRP CORP.
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LA JOLLA, CA 92037
Phone: (619) 453-4406

Topic#: 91-003 ID#: 91-059
Office: ONR
Contract #: N00014-91-C-0153
PI: Richard A. Altes, PhD

Title: Generalized Tomographic Imaging for Radar and Lidar

Abstract: In radar, lidar, sonar, and ultrasound systems, range resolution can be improved by increasing signal bandwidth, but azimuth (cross-range) resolution is limited by array or aperture size. The space-time transmission pattern is typically much narrower in range than in azimuth, yielding a line-like function that samples environmental reflectivity as the system scans its surroundings. Movement of transmitter or target causes the line-like sampling function to rotate. If the space-time transmission pattern has unbounded length, the environment would be represented by projections as in computer aided tomography, and inversion of the corresponding Radon transform would yield an image with improved cross-range resolution. For actual transmission patterns, a new generalization of the Radon transform, viz., an invertible line segment transform, yields the desired image if the line-like basis function used by the transform is approximated by the space-time transmission pattern of the radar/lidar/ultrasound system.

CHIRP CORP.
8248 SUGARMAN DRIVE
LA JOLLA, CA 92037
Phone: (619) 453-4406

Topic#: 91-010 ID#: 91-072
Office: SDC
Contract #: DASG60-91-C-0080
PI: Richard A. Altes, PhD

Title: Multisensor Acquisition and Tracking using Likelihood Statistics

Abstract: Optimum multisensor processing is accomplished by forming a large, distributed sensor array composed of subarrays that may be separated by large distances. Acquisition is accomplished by implementing a hypothesis test for an object in each volume element of the space to be searched. Such tests produce likelihood statistics that can be used for detection and position/velocity estimation. The size and shape of a volume element is determined by sensor bandwidth and subarray positions, and by predictable movement of objects (synthetic aperture processing). Closely spaced objects can be separated if volume elements are sufficiently small; small volume elements are associated with a highly distributed array, large bandwidth, and predictable motion observed over a long time. Tracking is accomplished by comparing the hypothesis test responses in overlapping volume elements and correcting a trajectory hypothesis accordingly. Commercial applications include robot vision, medical imaging, and automatic inspection systems for quality control.

CLEVELAND CRYSTALS, INC.
19306 REDWOOD AVENUE
CLEVELAND, OH 44110
Phone: (216) 461-1384

Topic#: 91-003 ID#: 91-456
Office: NSWC
Contract #: N60921-91-C-0185
PI: Gary C. Catella

Title: Fluxless Beta-Barium Borate

Abstract: BBO has been proposed as a promising nonlinear optical material for optical parametric oscillators (OPO) and many other 3-wave mixing applications. BBO OPOs provide the means to produce broadly tunable radiation from the ultraviolet to the infrared. Significant progress in this material characteristics and demonstrated OPO performance have been accomplished using conventional flux grown BBO. Cleveland Crystals believes that BBO would be an excellent material capable of meeting the SDIO's interest in wide spectral range sources for sensor applications. Specifically, a 266nm-pumped BBO OPO, with a BBO second harmonic generator, should theoretically cover a wavelength range of approximately 200-300nm. If the pump source was a diode-laser pumped solid-state laser system, then BBO would form the basis of and efficient, light weight, compact, space-based laser system. A new opportunity exists to develop BBO crystals using a fluxless growth process. This process has

the potential to radically increase the growth rates for BBO crystals and to remove flux inclusions, which presently limit quality. Phase I would be primarily a growth development effort, concentrating on intensive testing of a modified fluxless Czochralski method to achieve high quality beta-phase crystal growth. Phase I would also include crystal testing and OPO operation.

CREARE, INC.
PO BOX 71
HANOVER, NH 03755
Phone: (603) 643-3800
Topic#: 91-007 ID#: 91-317
Office: AF
Contract #: F33615-91-C-2135
PI: Michael G. Izenson
Title: Cryogenic Heat Pipe Diode
Abstract: Satellite-borne infrared sensors play a key role in any strategic defense architecture. Our concept for a cryogenic heat pipe diode transfers heat from a cryogenic focal plane array to active cryocoolers or a cryogenic radiator. The heat pipe diode contains an innovative micromachined wick which enables high capacity and a unique internal configuration which enables diode action. Diode action enables a redundant cryocooler without large heat leak penalties because the conductivity in reverse is less than 0.02% of forward conductivity. The diode's high forward conductivity reduces the mass of a cryogenic cooling system by 50 kg compared to a solid conductor. In Phase I we have developed a conceptual design for the heat pipe diode and fabricated samples of the micromachined wick. In Phase II we will fabricate and test individual elements of the heat pipe and test an integrated prototype.

CYBERNET SYSTEMS CORP.
1919 GREEN ROAD, SUITE B101
ANN ARBOR, MI 48105
Phone: (313) 668-2567
Topic#: 91-010 ID#: 91-300
Office: SDC
Contract #: DASG60-91-C-0070
PI: Brian T. Mitchell
Title: Vision-Based Decision Systems
Abstract: A pipeline strategy for man-machine decision modules has been developed. It has higher overall decision performance than the single decision module strategy, and is more computationally efficient than the multiple module approach. It provides a framework for controlled construction of orthogonal decision modules, and differs from the multiple module approach because each module only operates on data that remain undecided in the pipeline. It enables a clear approach to man-machine decision configurations in which the human operator focuses on only the difficult problems. Because the machine modules found within this configuration produce narrowed decision choices, those choices can be automatically routed to a human specialist trained to resolve this decision ambiguity. Under this organization, the human's performance is further extended because she/he sees fewer problems, and those problems can be displayed most efficiently since the decision task is more focused.

DEACON RESEARCH
2440 EMBARCADERO WAY
PALO ALTO, CA 94303
Phone: (415) 493-6100
Topic#: 91-001 ID#: 91-454
Office: SDC
Contract #: DASG60-91-C-0082
PI: Douglas J. Bamford
Title: Photocathode Enhancement by Surface Modification
Abstract: Modern applications of accelerators demand rugged and efficient photocathode sources. We are improving the quantum efficiency of rugged photocathode materials using surface plasmon excitation. Our scheme uses two light beams, one to excite the surface plasmons on a modified surface of the material and one to create excited electrons whose probability of escaping is enhanced 10-30 times by the presence of the surface plasmons. Such an enhancement places the quantum efficiency in the percent range, equal to the efficiency of the fragile cesiated materials currently being used. The useful lifetime of our new photocathode boosts the state of the art from less than ten hours to thousands of hours. Accelerators based on our laser driven photocathode system will be used for free electron lasers, lithography, and nuclear physics.

E-TEK DYNAMICS, INC.
1885 LUNDY AVENUE
SAN JOSE, CA 95131
Phone: (408) 432-6300
Topic#: 91-011 ID#: 91-050
Office: AF
Contract #: F49620-91-C-0090
PI: J.J. Pan

Title: Third-Order Nonlinear Optical Materials
Abstract: New organic nonlinear materials have been designed to have large third-order nonlinearities, high response speeds, high damage thresholds, and absorption edges below blue. The typical nonlinearity of designed materials is hundreds of times higher than urea, the absorption edge is as low as 388 nm, and the melting point (manage threshold) is 180C. Four of such designed materials have been synthesized. Their absorption spectra, nonlinearities (in powder), and melting points have been measured. The design principles lie in the fact that extending the conjugated pi-bond length may enhance the non-linearity but may prevent the rapid response and wide transparent band. To benefit both the nonlinearity and the response speed, the design emphasis has been put on determining the proper combination of a conjugated pi-bond length and an acceptor-donor pair.

EIC LABORATORIES, INC.
111 DOWNEY STREET
NORWOOD, MA 02062
Phone: (617) 769-9450
Topic#: 91-005 ID#: 91-191
Office: AF
Contract #: F29601-91-C-0067
PI: K. M. Abraham
Title: Solid State Pulse Power Battery
Abstract: Solid-state batteries have longer shelf-life and better reliability than their liquid electrolyte counterparts. They have long shelf-life due to little or no self-discharge, are rugged and can be assembled into leakage current-free bipolar structures. Bipolar batteries are desired for applications requiring high power drains such as portable communication equipment, electric drills, engine starters, and space-based pulse power sources. The basic cell unit of the battery being developed can be represented as: Li Insertion Anode/Solid Polymer Electrolyte/Li Insertion Cathode. Its development is made possible by the Li+ conductive solid polymer electrolytes with conductivities of 2x10E-3 ohmE-1 .cmE-1 at 25 degrees Celsius, recently discovered at EIC. The absence of elemental Li makes the battery highly safe while the "Li ion" concept ensures high energy density. The single cell voltage is ~3V. The theoretical specific energy of a single cell is 474 Wh/kg. Practical batteries will show a power capability as high as 100 kW/kg and a specific energy as large as 100 Wh/kg.

ELECTRON TRANSFER TECHNOLOGIES, INC.
PO BOX 160
PRINCETON, NJ 08542
Phone: (609) 921-0070
Topic#: 91-014 ID#: 91-528
Office: ARO
Contract #: DAAL03-91-C-0029
PI: William M. Ayers
Title: On-Site Generation of Phosphine for Electronic Devices
Abstract: Phosphine (PH3) is a gas necessary for making compound semiconductors such as InP, InAs(1-x)Px, GaP, and GaAs(1-x)Px as well as a dopant source for silicon. It is a very toxic gas with a TLV of 0.3 ppm. New regulations make the transport, storage, and handling of compressed gas cylinders of phosphine increasingly difficult. To avoid these problems, we are developing a compact point of use phosphine generator. The generator will produce semiconductor grade phosphine on demand at the semiconductor fabrication facility. This development will provide a much safer source of phosphine.

EMCORE CORP.
35 ELIZABETH AVENUE
SOMERSET, NJ 08873
Phone: (908) 271-9090
Topic#: 91-014 ID#: 91-527
Office: SDC
Contract #: DASG60-91-C-0059
PI: Gary S. Tompa
Title: Advanced Epitaxy Process Technology for Wide Bandgap Devices
Abstract: The research program uses a new advanced epitaxial growth technique, Vapor Transport Epitaxy, to reliably and repeatedly fabricate a variety of compound semiconductors with high throughput and over large areas. The compounds of special interest in Phase I are ZnSe (direct bandgap 2.7 eV) and ZnTe (direct bandgap 2.3 eV), because of their wide bandgap in the blue/blue-green portion of the visible spectrum. Their potential application in optical storage devises, multijunction solar cells, flat panel displays, visible holography, polymer fiber communications, underwater communications, radiation sensors, and blue light emitters make them strategically important materials. Their wide bandgaps, large range of lattice parameters, and dielectric constants also suggest applications as epitaxial passivation layers for numerous III-IV compounds (which do not possess high quality native oxides), for use as insulating layers, or for appropriate barrier layers for III-IV multiple quantum wells.

EMCORE CORP.
35 ELIZABETH AVENUE
SOMERSET, NJ 08873
Phone: (908) 271-9090
Topic#: 91-015 ID#: 91-612
Office: SDC
Contract #: DASG60-91-C-0064
PI: Dr. Peter E. Norris
Title: Improved Precursors for the Metalorganic CVD of YBCO Thin Films
Abstract: This program will develop suitable precursors, particularly for barium which exhibit increased volatility and stability in the metalorganic chemical vapor deposition (MOCVD) process of HTSC films by pyrolyzing organometallic precursors at the substrate surface. MOCVD offers the advantages of scale-up capability, highly oxidizing deposition conditions, low-temperature deposition capability, and excellent compositional control. In contrast to the case of III/V compound semiconductors, the precursors commonly available for Y, Ba and Cu are low volatility solids. Which unfortunately need substantial heating (125-250 degrees Celsius) to obtain useful growth rates. This demands high temperature components, heated lines and a more complex MOCVD system design. The high temperature, though encourage a significant degree which adversely affects the deposition process.

ENERGY COMPRESSION RESEARCH CORP.
990 HIGHLAND DRIVE, SUITE 101
SOLANA BEACH, CA 92075
Phone: (619) 259-3222
Topic#: 91-005 ID#: 91-547
Office: ETDL
Contract #: DAAL0-91-C-0139
PI: David Giorgi
Title: Light Activated Switches for Megahertz Pulsed Induction Accelerator
Abstract: There is a considerable need for high power jitter-free switching in the SDIO induction accelerator program. The high power switches currently available are mainly based on an electrical discharge in gas or vacuum, and therefore have certain limitations in pulse risetime, repetition rate, temporal jitter, reliability, lifetime recovery, switch size, and switch weight. An alternative high power switch technology, based on a light activated semiconductor switch, is proposed which exceed the limitations of discharge tubes. This type of switch consists of back-biased semiconducting junction which, in the open state, has no carriers in the conduction band and therefore blocks the flow of current. The sudden generation of carriers by the absorption of a laser pulse closes the switch and large currents can flow. This type of device can switch large powers at high power densities and can therefore be orders of magnitude smaller than an equivalent discharge tube. The solid state risetimes in the region of 100 psec or less, and longer lifetime than conventional switches, along with essentially jitter-free operation. Finally, due to the high power densities available, considerable savings will be made in space and weight.

ENTECH, INC.
PO BOX 612246
DFW AIRPORT, TX 75261
Phone: (214) 456-0900
Topic#: 91-005 ID#: 91-239
Office: NASA
Contract #: NAS3-91-C-26316
PI: Mark J. O'Neill
Title: Sol-Gel Glass Prismatic Cover for a Photovoltaic Cell
Abstract: Over the past 6 years, ENTECH has developed a unique prismatic cover for photovoltaic cells. The new cast silicone cover optically eliminates the usual shadowing loss caused by metal gridlines on the illuminated cell surface, thereby boosting cell performance to previously unattainable levels. The new cover has been used to set ten world records for cell performance, including 31% in NASA-Lewis testing for a multi-junction space cell. However, the silicone material has serious drawbacks in space, including UV-induced darkening and oxygen erosion in low earth orbit. Over the past 6 years, GELTECH has developed a unique sol-gel casting process for making high-quality optical glass products. GELTECH is the only company in the world that is successfully making and selling sol-gel glass lenses. The objective of this project is to marry ENTECH's prismatic cover technology with GELTECH's sol-gel casting process to form an efficient stable reliable all-glass prismatic solar cell cover.

EPION CORP.
4R ALFRED CIRCLE
BEDFORD, MA 01730
Phone: (617) 275-3703
Topic#: 91-014 ID#: 91-098
Office: ONR
Contract #: N00014-91-C-0100
PI: Allen R. Kirkpatrick
Title: Single Crystal Diamond Thin Films

Abstract: Technology for vapor-phase growth of thin film diamond is advancing rapidly and valuable markets exist for a wide range of diamond films products. However, some of the most important prospective applications, particularly those in diamond semiconductor electronics, will not be realized unless single crystal diamond films can be produced on reasonably inexpensive nondiamond substrates. The properties of diamond are such that it is not compatible with methods of heteroepitaxial growth which have been successfully employed with other materials, but recent investigations involving very high dose carbon ion implantation into certain metals such as copper have shown promise for formation of diamond heteroepitaxially upon the metal lattice. If such an approach can be utilized to induce coordinated growth of diamond, then single crystal metal films produced on semiconductor wafers will be able to serve as practical substrates for preparation of large area single crystal diamond films. The objective of this SBIR program is to demonstrate heteroepitaxial formation of diamond upon single crystal thin films of copper. A successful result will establish the technical basis for a wide range of single crystal diamond film applications.

ETALON, INC.
33 HANSON STREET, #2
BOSTON, MA 02118
Phone: (617) 482-2488
Topic#: 91-011 ID#: 91-504
Office: ARO
Contract #: DAAL03-91-C-0028
PI: Mark W. Miles
Title: Resonant Membrane Spatial Light Modulators
Abstract: This project will result in high speed, low cost spatial light modulators with applications including optical processing, holographic memories, HDTV, and flat-panel displays. These SLMs are micro-mechanical and will be fabricated on glass or plastic substrates using efficient dielectric materials and mature, low-cost/high volume vacuum coating technologies. Characteristics include sub-microsecond speeds, pixel sizes of 20 microns, optical efficiencies >95%, and substrates > 1 meter in size. Transistors will not be required at each pixel, realizing two major advantages. First, yields for large scanned displays, such as those used in laptops, are increased tenfold. Second, the need for multi-million dollar optical steppers required for AMLCDs is eliminated. High optical efficiencies will preclude the use of backlighting and make possible dazzlingly bright arrays ranging in size from "Watchmen" to Billboards, in indoor ambient or raw sunlight conditions.

FAIRFAX MATERIALS RESEARCH, INC.
5613 MARBLE ARCH WAY
ALEXANDRIA, VA 22310
Phone: (703) 960-4840
Topic#: 91-013 ID#: 91-321
Office: NSWC
Contract #: N60921-91-C-0247
PI: Dr. N.P. Louat
Title: Mechanical Properties of Metal-Void Composites
Abstract: Materials for future technologies must be strong, tough and light. A generic improvement is offered by metal-void composites HIPed from nanoscale powders, with gas-pressurized void content of 10-30%. Strength to weight ratios and strengths are well above those for conventional materials. High temperature structural stability, resistance to dislocation, grain boundary and crack propagation, and exceptional damping properties, demonstrated by computer modeling in this Phase I project, combine to indicate great potential for usage in aerospace and automobile industries.

FIBER AND SENSOR TECHNOLOGIES
PO BOX 348
BLACKSBURG, VA 24060
Phone: (703) 552-9118
Topic#: 91-012 ID#: 91-627
Office: AF
Contract #: F29601-91-C-0061
PI: Dr. Richard Goff
Title: Health Monitoring and Control System Reconfiguration for Large Space Trusses Using Optical Fiber Sensors
Abstract: The next generation spacecraft will be made of new strong, lightweight materials with little damping so that active vibration suppression is essential. These spacecraft, functioning in a remote hostile environment where immediate repair is precluded, may sustain damage from external disturbances and aging. To address the operational requirements of future spacecraft, this program is developing an innovative health monitoring system to monitor the integrity of the structure and--in the event of failure--to automatically reconfigure the control system enabling the spacecraft to continue to meet its mission requirements, or to degrade gracefully. In addition to conventional sensors, this health monitoring system also incorporates optical fiber sensors which can be embedded directly in the structural material to detect damage at its inception while monitoring the macro-scale behavior of the spacecraft.

FIBER CONCEPT, INC.
215 LOGAN COURT
PHILADELPHIA, PA 19103
Phone: (215) 568-5664
Topic#: 91-013 ID#: 91-335
Office: SDC
Contract #: DASG60-91-C-0098
PI: H. Benny Soebroto
Title: 3-D Composite for Threaded Fastener
Abstract: An advanced, innovative threaded composite fastener has been developed by Fiber Concept, Inc. The novel 3-D fiber architecture of the fastener provides for the continuity of the reinforcement fiber throughout the part so that any machining that is performed on the stock composite does not interfere with the transfer of longitudinal and torsional load from the threads to the body of the fastener. The high shear strength and the use of fiber architecture which can be automated will provide for a reliable and low cost composite for various applications.

FOSTER-MILLER, INC.
350 SECOND AVENUE
WALTHAM, MA 02154
Phone: (617) 890-3200
Topic#: 91-005 ID#: 91-557
Office: DNA
Contract #: DAN001-91-C-0091
PI: K. Jayaraj
Title: Ultrahigh Energy Storage Polymer Capacitors
Abstract: Foster-Miller proposes an innovative technique to fabricate all polymer, ultrahigh energy density double layer capacitors to meet Space Power Conditioning needs of the SDI. The Foster-Miller approach is based on infiltrating an ionically conducting polyelectrolyte with the monomer of an electrically conducting polymer. The monomer will be polymerized "in-situ" achieving a high degree of molecular orientation to result in a polymer with a conductivity, on the order of 7500 S/cm. The conducting polymer will have a nodular surface with very high surface area which translates into very high energy densities. The resulting interpenetrated polymer network (IPN) will be thin and flexible and can be fabricated into very large capacitors. In Phase I, we will evaluate current polymers, select a conductor/electrolyte combination and demonstrate the feasibility of our approach by fabricating breadboard capacitors. In Phase II, the processes will be optimized to realize the full performance potential of this approach and large prototype capacitors will be fabricated and tested. Demonstration of reliable, all polymer, very high energy storage capacitor will form a firm basis for a commercially supported Phase III program.

GEMINI COMPUTERS, INC.
PO BOX 222417
CARMEL, CA 93922
Phone: (408) 373-8500
Topic#: 91-010 ID#: 91-617
Office: SDC
Contract #: DASG60-91-C-0083
PI: Tien F. Tao, PhD
Title: High Assurance Trusted Critical and Safe Computer Research
Abstract: A safe and critical computing policy is proposed. It considered the existing government guidelines for safety and criticality and for information security. The policy included confidentiality (secrecy), integrity and assured services (fault tolerance). Safe and critical computer technology is being developed by the integration and enhancement of the following disciplines: 1. fault tolerance against hardware and software faults including unintentional mistakes and malicious software attacks; 2. high assurance trusted computers and networks and; 3. correct software. Fault tolerance mechanisms will be implemented in the framework of three mapped layered architectures: a.layered infrastructure for the safe computing technology; b. layered OSI-ISO distributed system architecture including network security; c. layered architecture for trusted computers and secure distributed systems. The architecture is based on a loosely coupled network of several trusted computer nodes which are tightly coupled multiple computers. Most fault tolerance mechanisms will be implemented outside the Trusted Computing Base to minimize their effects and re-evaluation of the trustedness of the safe computers. The criticality will be enhanced by the concurrent computing capability based on a pre-emptive priority interrupt mechanism of multiple processors of the tightly coupled nodes.

GUMBS ASSOCIATES, INC.
11 HARTS LANE
E. BRUNSWICK, NJ 08816
Phone: (908) 257-9053
Topic#: 91-015 ID#: 91-033
Office: SDC
Contract #: DASG60-91-C-0088
PI: Dr. P.C. Sekhar
Title: High Current Density High-Temperature Superconductors

Abstract: A novel class of high temperature superconductors, oxygenated Cu phthalocyanines, is prepared which has good match between Cu and Oxygen energy levels as in extant high temperature superconductors as well as firm pic-ing of magnetic flux due to a high density of defects. These two properties yield high temperature combined with high cur- densities absent in extant materials. Synthetic work is based on prior successful syntheses of well characterized oxygenate- thalocyanines. Applications include power generation, faster computers and magnetic levitation.

HAYES AND ASSOCIATES
3737 THIRD AVENUE #308
SAN DIEGO, CA 92103
Phone: (619) 299-2267
Topic#: 91-005
Office: ETDL
Contract #: DAAL0-91-C-0141
PI: Claude Hayes, PhD
ID#: 91-003

Title: Aggregate Suspended Particle Electric Charge Collector

Abstract: ASPECC makes use of the exponentially large increase in surface area which accompanies a fractionated specific volume. Though the math indicates voltages as high as 10E9 at 10E6 joules for some of the examples described herein, Phase I and II of this project will only pursue the testing of an ASPECC at 100 to 300 volts due to technical limits of presently available materials. Since electric charge can be stored as a direct function of surface area x charge, the total charge storage can be increased by the surface area improvement factor. This technology is applicable to electrostatic propulsion and munitions, X-ray and ion beam devices, and Lasers. Phase I will provide a paper study relative to technical problem resolution, design and materials selection. Phase II will provide for a prototype construction and testing of a low voltage high charge ASPECC. Phase III will attempt technical application of the technology to pulse power devices, Lasers, and electrostatic weapons.

HI-Z TECHNOLOGY, INC.
11180 ROSELLE STREET, SUITE G
SAN DIEGO, CA 92121
Phone: (619) 535-9343
Topic#: 91-006
Office: NASA
Contract #:
PI: Norbert B. Elsner
ID#: 91-548

Title: Low Work Function Cathode Materials for High Performance ARC-Jet and Ion Thrusters

Abstract: The work function is the energy needed to remove an electron from a metal surface, such as in thermionic emission. A lower work function allows the emitting surface to operate at a much reduced temperature for the same current. Low work function single phase materials with refractory properties allow cathodes to operate at a lower temperature and should permit longer lifetimes at temperatures of >1500C. These materials can be for high performance arc-jet engines and ion thrusters. They may also find use in new types of vacuum tubes which would be more efficient and compact. Application of this technology would revolutionize high power amplifiers, power supplies, and microwave transmission technology.

HMJ CORP.
10400 CONNECTICUT AVENUE, SUITE 404
KENSINGTON, MD 20895
Phone: (301) 946-1586
Topic#: 91-005
Office: AF
Contract #: F33615-91-C-2148
PI: William D. Jackson
ID#: 91-324

Title: Cryogenically Cooled Controlled Switch for Space Power Conditioning

Abstract: A solid state switch for operation at cryogenic temperature is being developed that will provide multi-megawatt power conditioning in the rapidly expanding field of low temperature electronics. Since existing controlled switches are not directly suitable for cryogenic operation, only a fundamental approach can develop structures capable of low loss and reliable operation in the temperature range below 80K. In Phase I, the key parameters are being determined and a design basis prepared for the actual fabrication and testing of experimental controlled switches in Phase II. This approach will develop the design basis required and demonstrate prototype switching components for both military and commercial space high performance power conditioning. It will also be of value to terrestrial power conditioning systems where low temperature operation is required.

HOLLI RESEARCH
8579 MORTENSON LANE
FAIR OAKS, CA 95628
Phone: (916) 967-3064
Topic#: 91-006
Office: AF
Contract #: F29601-91-C-0096
PI: Ritch D. Hollingsworth
ID#: 91-117

Title: Advanced Mandrel for Fabrication of Filamentary Composite Structures
Abstract: Holli Research's CMIS mandrel system will make better mandrels for medium to large filamentary advanced composite structures. With current technology, the mandrels used to fabricate composite parts weigh 20 times more then the finished part. This, in turn, causes fabrication, dimensional, and handling problems. Furthermore, these existing mandrel systems have high recurring expenses, adding to the already high acquisition costs of advanced composite products and the systems they are used in. The CMIS mandrel is lightweight, reusable, and removable through relatively small polar ports. Disassembly is performed from the outside of the finished part, reducing the possibility of damaging the part. Due to its unique design and light weight, the CMIS mandrel is extremely stiff. This allows for the fabrication of larger and more accurate composite parts. Uses for the CMIS mandrel include composite; rocket motor cases, fuel tanks, aircraft fuselages, space structures, and other hollow designs.

HYPRES, INC.
175 CLEARBROOK ROAD
ELMSFORD, NY 10523
Phone: (914) 592-1190
Topic#: 91-015 ID#: 91-199
Office: AF
Contract #: F19628-91-C-0102
PI: Edwin E. Stebbins
Title: Superconducting Correlation Impulse Receiver
Abstract: HYPRES produced a superconducting 11.5 GHz 16-stage correlator operating at 4K and will produce a 20 GHz 1024-stage correlator which dissipates 10mW. Superconducting digital logic can be used to create 5uW/gate 20 GHz processing systems. Correlators can detect and measure time-of-arrival of pseudo-random (PRN) coded signals many dB down in noise. PRN signals are: transmitted with low energy spread across the spectrum for a low probability of intercept, appear as noise to conventional receivers, and have a low probability of exploitation without knowing the PRN code. Stealth LPI radar systems using a 1024-stage correlator can transmit -30dB less power. The same correlator for LPI/LPE communication systems can detect a -30dB degraded signal or multiplex 32 channels, and cannot be exploited without knowing the PRN code. Used for Automatic Direction Finding and Non-Cooperative Target Recognition, correlators can also detect previously acquired signals.

HYPRES, INC.
175 CLEARBROOK ROAD
ELMSFORD, NY 10523
Phone: (914) 592-1190
Topic#: 91-015 ID#: 91-205
Office: SDC
Contract #: DASG60-91-C-0063
PI: Masoud Radparvar
Title: NbN Tunnel Junctions with Thermally Oxidized Sputter
Abstract: There has been considerable interest in recent years in fabrication of all niobium nitride superconducting circuits. The high transition temperature of NbN is technologically important because it allows NbN-based circuits to be cooled with small and reliable closed cycle refrigerators (CCR). We have demonstrated the feasibility of operating NbN-based Josephson circuitry in a CCR environment. The fabrication of such circuits relies on the development of a process that reliably produces Josephson tunnel junctions. We have developed a process capable of producing high quality NbN/MgO/NbN devices. Our process exploits thermally oxidized sputter-deposited magnesium as a tunnel barrier and provided a relatively reproducible means for tunnel barrier formation. However, a major problem with sputter-deposited Mg is the presence of excessive unoxidized magnesium. This excess Mg reacts with niobium nitride electrodes and forms poor interfaces. Use of a diffusion barrier between niobium nitride and magnesium should alleviate this problem. The goal of this research is to identify a suitable diffusion barrier.

IAP RESEARCH, INC.
2763 CULVER AVENUE
DAYTON, OH 45429
Phone: (513) 296-1806
Topic#: 91-002 ID#: 91-340
Office: AF
Contract #: F08630-91-C-0043
PI: David P. Bauer
Title: High Efficiency Hypervelocity Railgun Launcher
Abstract: The objectives of the proposed effort are to increase the efficiency, reduce power supply size, and show hypervelocity feasibility of electromagnetic railguns. Our approach is to use a novel configuration of highly coupled conductors which result in near zero residual magnetic energy in the railgun, at projectile launch. Successful implementation of this concept will greatly improve railgun efficiency, leading to much smaller power supply size. The approach will work for hypervelocity, as well as for lower velocity launch regimes.

IAP RESEARCH, INC.
2763 CULVER AVENUE
DAYTON, OH 45429
Phone: (513) 296-1806
Topic#: 91-005 ID#: 91-381
Office: SDC
Contract #: DASG60-91-C-0101
PI: Neal Clements
Title: Passive HTSC Fault Current Limiter Circuit Breaker
Abstract: The Passive HTSC Fault Current Limiter Circuit Breaker project will develop a circuit breaker with sharp, fast current limiting characteristics which can be set close to the interrupting level. The current limiter is made with patterned thin film high temperature superconductor on a lanthanum aluminate substrate. The limiter circuit breaker is uniquely suited to protecting loads which are easily damaged by high fault currents. Typical loads include semiconductor devices, microwave devices and superconducting circuits.

ILLINOIS SUPERCONDUCTOR CORP.
1801 MAPLE AVENUE
EVANSTON, IL 60201
Phone: (708) 491-7661
Topic#: 91-005 ID#: 91-303
Office: ETDL
Contract #: DAAL0-91-C-0140
PI: James D. Hodge
Title: Self-Restoring Fault Current Limiter Utilizing High Temperature Superconductor Components
Abstract: Illinois Superconductor Corp. will design and test fault current limiters which use recently discovered High Temperature Superconducting materials to protect vital spacecraft components from unpredictable power surges and spikes. These devices will also find use in the ultra-high speed switching of very large currents, a key to future electromagnetic space launch systems. The key to these components is the clever use of what has been considered a weakness in the new superconductors - a limit in the material's ability to carry current. Through careful engineering, the current limiter carries normal levels of electricity with no losses due to resistance. When a power spike occurs, the device losses its superconductivity and becomes an electrical brake, protecting more fragile devices downstream from the surge. This product can be used in the commercial power distribution industry. There, a device to protect electrical circuits from power surges can save utilities hundreds of millions of dollars in capital and operational costs.

IMPLANT SCIENCES CORP.
35 CHERRY HILL DRIVE
DANVERS, MA 01923
Phone: (508) 777-5110
Topic#: 91-014 ID#: 91-115
Office: SDC
Contract #: DASG60-91-C-0060
PI: S. N. Bunker
Title: Single Crystal Silicon Carbide on Sapphire Substrates
Abstract: The advantages of silicon carbide as a high temperature, radiation tolerant semiconductor material are well known. Unlike comparable materials, such as diamond, preparation of functional devices has been relatively straight forward with the major limitation continuing to be the defect density of the substrate material. A method is proposed using ion beam synthesis to produce single crystal, low defect material on a sapphire substrate.

INDUSTRIAL SENSORS ACTUATORS
400 HESTER STREET
SAN LEANDRO, CA 94577
Phone: (415) 568-7720
Topic#: 91-001 ID#: 91-278
Office: SDC
Contract #: DASG60-91-C-0102
PI: Bruce W. Maxfield
Title: Piezoelectric Actuator Sheet as a Low-Cost Deformable Mirror
Abstract: Adaptive optics systems compensate for the distortion problems in obtaining diffraction limited performance in imaging and power projection optics. An adaptive mirror will meet requirements for directed energy and imaging systems at one-hundredth the cost of conventional deformable mirrors. The fabrication of the mirror centers on a sheet of piezoelectric material that has hundred of actuators incorporated into it. Dynamic bandwidth, cooling, and reliability will be enhanced. Key to this Phase I program will be the development and testing of the ceramic wafers. Applications exist for directed energy weapons, space object imaging, space based sensing, and commercially in short-wave photolithography.

INTEGRATED APPLIED PHYSICS, INC.
140 E. SANTA CLARA STREET, #19
ARCADIA, CA 91006
Phone: (818) 821-0652
Topic#: 91-005 ID#: 91-231
Office: SDC
Contract #: DASG60-91-C-0074
PI: Dr. Mun S. Choi
Title: Electron-Beam Controlled Semiconductor Switch
Abstract: Electron beam controlled GaAs switches, operating in the linear mode or being triggered into a semipermanent conducting state are being developed in this work, as switches for pulsed power systems including linear induction accelerators. Key advantages are: High repetition rate (MHz), Small delay and jitter (<nsec), Closing and opening capability, High efficiency driver, Scaleable in current, and voltage. Electron beam controlled semiconductor switches, like laser controlled photoconductive switches, are attractive because they have the potential to switch high powers with low jitter, and voltage fall times of nsec. Electron beam drivers are highly efficient when compared to the lasers required by photoconductive switches. The overall technical objective of this work is to demonstrate the feasibility of producing the switches incorporating both the electron beam driver and the GaAs switch in a single modular unit.

INTEGRATED SYSTEMS ASSEMBLIES CORP.
PO BOX 9210
SCHENECTADY, NY 12309
Phone: (518) 393-9589
Topic#: 91-014 ID#: 91-545
Office: SDC
Contract #: DASG60-91-C-0084
PI: Charles W. Eichelberger
Title: Low Dielectric Constant Packaging Material for Multichip Modules
Abstract: A low dielectric constant packaging material for use in the fabrication of Multichip Modules is proposed. Two forms of the material will be developed. A first form will have a dielectric constant of 2.4 and a second, more advanced form, will have a dielectric constant less than 2.0. The proposed program will include development of the material and demonstration of the material for use in multichip modules. To demonstrate feasibility candidate dielectrics will be subjected to a battery of accelerated stress tests including severe thermal shock, accelerated thermal aging, boiling water and adhesion. Other coupons will be characterized for dielectric constant and loss factor to >20 GHz. Processing related characteristics will also be demonstrated/evaluated including ability to coat and cure material and form holes with laser ablation.

INTERFEROMETRICS, INC.
8150 LEESBURG PIKE, SUITE 1400
VIENNA, VA 22182
Phone: (703) 790-8500
Topic#: 91-011 ID#: 91-372
Office: SDC
Contract #: DASG60-91-C-0095
PI: Dr. A. K. Drukier
Title: A Spatial Light Modulator for Optical Signal Processing
Abstract: Optics, due to its inherent parallelism, high temporal-spatial bandwidth and non-interfering communications, has the potential of breaking through the performance barriers faced by conventional technologies and is therefore a candidate for future parallel computers. One of the main needs is efficient, low energy, optical gates and/or electro-optic convertors which can be manufactured in large quantities with a reasonable production yield. We point out that superconducting light sensors/switches require orders of magnitude less energy than the semiconducting devices. The SDIO application is jammer nulling in null steering for phased array radar which requires the solution of systems of linear equations. Current goal for military applications is to reach solution of system of linear equations with 10 unknown in less than 2.5 microseconds. The proposed SA-SLM array will provide the solution of the above proposed class of problems within 1.0 microseconds. The results of the Phase I effort, are very encouraging: a.The analytical tasks show the order of the magnitude advantage of the SA-SLMs in three important classes of optical computing applications; b. We fabricated and tested 256x256 pixels arrays, i.e., increased the size of the array six-fold. Recently produced 256x256 arrays have parameters that are two times better than the older 100x100 arrays. The 360x360 arrays are being produced and the fabrication of 512x512 arrays is expected in February/March; c. The individual 100x100 arrays were produced, whereas mass production of 50 arrays per batch was recently achieved.

INTERSPEC, INC.
110 W. BUTLER AVENUE
AMBLER, PA 19002
Phone: (215) 540-9190
Topic#: 91-003 ID#: 91-083
Office: ONR
Contract #: N00014-91-C-0150
PI: Hesham Attia, PhD

Title: Large Coherent Arrays for Laser Radars
Abstract: Our "self-cohering" methods permit increasing the receive aperture of a laser radar far beyond what conventional optical designs allow, thus achieving unprecedented resolution and range capabilities. A coherent aperture is formed from a number of much smaller subapertures without requiring strict mechanical rigidity. The otherwise useless distorted aperture is phase corrected with no need for a "phase-up" source of opportunity by processing the reradiated field from a fairly general scene in a number of innovative ways. Diffraction limited performance is achieved. Large aperture lidars find numerous applications where mechanical vibrations exist (e.g., an optical "smart skin" distributed over the surface of an aircraft for detecting low RCS ground vehicles, or for theater missile defense). Our methods compensate for the dynamic distortion due to vibrations and phase errors due to the atmosphere. Moreover, optical subapertures can be connected to the detectors using light-weight, inexpensive, flexible optical fibers with no phase trimming. Resulting phase errors are corrected as well.

IRVINE SENSORS CORP.
3001 REDHILL AVENUE, BLDG. 3, SUITE 208
COSTA MESA, CA 92626
Phone: (714) 549-8211
Topic#: 91-003 ID#: 91-161
Office: ONR
Contract #: N00014-91-C-0184
PI: John C. Carson
Title: Fault-Tolerant Wafer Scale Integration
Abstract: This program replaces the conventional passive interconnect substrate used in multi-chip modules with an active silicon substrate. This application uses the active substrate (ASIC) to implement a fault tolerant memory system. The substrate provides EDAC, automatic SEU scrubbing, memory mapping and reconfiguration, spares management, system I/O power control and self test to a 3-D stacked memory module. The substrate is itself fault tolerant through the use of self-checking reconfigurable redundant circuits. Using conventional 1 Mbit SRAMs, an 80 Mbit memory (32 Mbit data, 8 Mbit EDAC, 40 Mbits spare) with >.999 reliability over a 10-year mission life can be packaged in 0.15 cubic inch, a density improvement of over 2 orders of magnitude over a planar HDI on DEM-E module approach, with a similar increase in reliability, junction temperature rise is ~1 degree C/watt. Multiple modules packaged in a single hybrid achieve highly dependable memory systems. Production cost of these modules is projected to be similar to conventional memory systems.

ITERATIONS, INC.
105 LEXINGTON AVENUE, SUITE 6D
NEW YORK, NY 10016
Phone: (212) 642-2920
Topic#: 91-010 ID#: 91-350
Office: ARO
Contract #: DAAL0-91-C-0036
PI: Martin Rofheart
Title: Scalable Parallel Algorithms for Multidimensional Digital Signal Processing
Abstract: In this program, a study of the mapping of a new class of multidimensional discrete Fourier transform (MD DFT) algorithms to broadcast mode multiprocessors is proposed. These algorithms are designed to scale from limited to massive degrees of parallelism. Conventional approaches map variations of row-column of vector-radix algorithms to parallel architectures. These algorithms require intensive interprocessor architectures. To overcome this difficulty reduced transform algorithms are mapped to multiprocessors. This new method applied to $d-$dimensional DFT of size p^{n} in each dimension, where p is any prime including 2. The main features of this algorithm are that it requires no interprocessor communications, and scales to match the degree of parallelism of any multiprocessor. This study will include the detailed definition of the modules required to realize 2D, 3D, and 4D implementations of the algorithms. The modules are to be realizable in a high level language, and can be retargeted to specific implementation of multiprocessors that support the required primitives.

LASER PHOTONICS TECHNOLOGY, INC.
1576 SWEET HOME ROAD
AMHERST, NY 14221
Phone: (716) 636-3626
Topic#: 91-003 ID#: 91-392
Office: AF
Contract #: F49620-91-C-0051
PI: Guang S. He
Title: Organic Kerr-Liquid-Filled Hollow Fiber for Lidar Sensor System
Abstract: Optically pumped Kerr-liquid filled hollow fiber devices are proposed as a novel multiwavelength coherent light source with applications in lidar and coherent optical sensor systems. The devices are based on stimulated Rayleigh-Kerr scattering from a Kerr-liquid-filled hollow fiber system. The proposed devices are superior to other existing methods of generating

coherent multiwavelength emission in that they capable of generating super-broad band coherent multiwavelength output, highly efficient in converting a monochromatic pump input to the multiwavelength output, compact and lightweight, and of low cost.

LASER SCIENCE COMPANY
1504 ILLINOIS
AMES, IA 50010
Phone: (515) 292-4416

Topic#: 91-013 ID#: 91-043
Office: ARO
Contract #: DAAL01-91-C-0041
PI: Simon Hsu

Title: Enhanced Wear and Corrosion Resistance of Composites with Laser Coating

Abstract: Composite materials used in space structures require protection from corrosion, oxidation and wear. Current techniques such as vapor deposition and plating suffer many drawbacks. Phase I research will develop a simple, reliable laser coating technique to apply amorphous metallic coatings on metal matrix composites and thereby provide tribologically and environmentally effective surfaces. Rapid solidification effects associated with laser processing will control the amorphousness of the coatings. The amorphous coating will be characterized with scanning electron microscopy, x-ray diffraction and NDE techniques. Laser coating of composites with amorphous materials offer many opportunities to protect composite structures. NDE technique will facilitate as on-line monitoring tool for the uniformity and reliability of amorphous coatings on large scale composite structures. The process can be applied to light weight structures in space vehicles, aircrafts and automobiles.

LASER SCIENCE COMPANY
1504 ILLINOIS
AMES, IA 50010
Phone: (515) 292-4416

Topic#: 91-013 ID#: 91-044
Office: ARO
Contract #: DAAL03-91-C-0041
PI: Bruce C. Janvrin

Title: Laser Grown, Fluorinated Diamond Films

Abstract: The moving mechanical assemblies in space structures need solid lubricants for extreme environments. Fluorinated diamond or diamond-like carbon offers promise because its diamond-like carbon provides low friction and fluorine atoms can passivate the surface layer. Phase I work will develop an innovative photothermal chemical vapor deposition technique to synthesize fluorinated diamond films on space bearing material substrates such as 440C stainless steel and SiC. Halogenated methane and fluorine will be used as precursor gases. Laser grown films will be characterized with x-ray diffraction, Raman spectroscopy and chemical analysis. Friction behavior of these films will be studied and compared with the currently used MoS2 and poly tetra fluoroethylene. The lubricants would help space tribosystem components such as mainshaft bearings, gimbals, cage bearings, etc. Additional spin-offs are in microelectronics, optical and machine tools.

LASER SCIENCE COMPANY
1504 ILLINOIS
AMES, IA 50010
Phone: (515) 292-4416

Topic#: 91-014 ID#: 91-046
Office: ONR
Contract #: N00014-91-C-0102
PI: Simon Hsu

Title: Laser Deposition of Cubic Boron Nitride For Electronic Materials

Abstract: Cubic boron nitride (CBN) has potential as a high quality, high temperature semiconductor like diamond and SiC. Synthesis of CBN by chemical vapor deposition and physical vapor deposition techniques yielded films of low quality that can not be used for electronic devices. Phase I will develop an innovative laser technique involving Nd:YAG and excimer lasers to grow heteroepitaxial films of CBN on silicon substrate. The technique consists of congruent ablation and evaporation of a high purity hexagonal boron nitride target with the laser beams so that highly energetic species will be created which subsequently bombard the silicon substrate to form CBN. The proposed laser technique also includes methods to minimize particulate formation in the films. Films will be characterized with x-ray diffraction, Raman and IR spectroscopies. Applications of CBN films occur in electronics, optical, and machine tool devices and as an excellent substrate for diamond film growth.

LASER SCIENCE, INC.
29 LANDSDOWNE STREET
CAMBRIDGE, MA 02139

Topic#: 91-003 ID#: 91-087
Office: ONR
Contract #: N60530-91-C-0137

Phone: (617) 225-2929 PI: Robert Nordstrom
Title: Frequency-Stable Laser Source Operating in 1 Micrometer Region
Abstract: Lasers operating with wavelengths near 1 micrometer may have many uses from laser radar sources to communications links. They need solid-state construction, small size, and good output power. Their main limitation of adequate frequency stability, Laser Science, Inc. is designing and constructing a frequency-stabilization servo. This add-on servo will control the laser frequency of inexpensive laser sources at far less cost than constructing an intrinsically stable laser. The frequency-stabilization technology, already demonstrated by Laser Science, Inc., at longer wavelengths, can be packaged in a compact, rugged design suitable for field use.

LASER SYSTEMS AND RESEARCH CORP. Topic#: 91-003 ID#: 91-546
1928-A DON LEE PLACE Office: ONR
ESCONDIDO, CA 92029 Contract #: N60530-91-C-0364
Phone: (619) 480-6055 PI: Carl J. Buczek
Title: Integrated Beam-Steering Module
Abstract: Integrated modules for laser beem steering will be developed to reduce manufacturing costs, eliminate optical-encoder alignment, and minimize subsystem assembly. The proposed modules incorporate advances in detectors, masking technologies, LED's, laser diodes, digital motor control, binary or kinoform optics, and fiber optics. This design approach suits a range of wavelengths extending from the IR through the visible. Modules will be applicable to strategic and tactical laser radars and to 64K final applications.

LINARES MANAGEMENT ASSOCIATES, INC. Topic#: 91-014 ID#: 91-146
PO BOX 336 Office: ONR
SHERBORN, MA 01770 Contract #: N00014-91-C-0098
Phone: (508) 653-5458 PI: Robert C. Linares
Title: Epitaxial Diamond/CBN Structures and Diamond Films
Abstract: Diamond and cubic boron nitride (CBN) semiconductor devices have the potential to operate at higher temperature, higher voltage, at higher frequency and power and under more harsh radiation environment than conventional semiconductors, and as emitters and detectors in the ultra-violet and visible. Epitaxial diamond/CBN structures hold the potential for further improvement of these devices and for providing tunable optical and semiconducting properties. Under the Phase I program, epitaxial single crystal semiconducting diamond substrates using low pressure chemical vapor deposition (CVD). Electrical resistivity and activation energy have been measured for a range of boron doping concentrations, at temperatures from room temperature to 700C. Single crystal diamond films can be grown with varied thickness and doping level for device fabrication and testing. Epitaxial diamond single crystal films have also been grown on CBN crystals. The growth of single crystal CBN on diamond by CVD is under continuing investigation.

LONE PEAK ENGINEERING, INC. Topic#: 91-003 ID#: 91-165
1270 WEST 2320 SOUTH, SUITE F Office: AF
WEST VALLEY, UT 84119 Contract #: F29601-91-C-0065
Phone: (801) 975-7979 PI: Curtis Griffin
Title: Maintenance-and-Vibration-Free Solid Electrolyte Cryogenic Cooler
Abstract: The cooling required for the proper operation of various sensors and instruments is a key problem in space-based facilities. A novel concept has been developed at Lone Peak Engineering based on the compression of a gas to high pressures using a solid electrolyte compressor. Rapid expansion of the compressed gas (Joule-Thomson effect) can be used to cool spacecraft instruments and equipment. Some of the advantages of a SEC over mechanical compression include no moving parts and therefore no maintenance and no vibration, improved reliability, and closed loop operation. During this Phase I project, a solid electrolyte compressor will be designed, assembled and tested using a zirconia solid electrolyte. The feasibility of compressing oxygen to high pressures using the SEC will be demonstrated in Phase I. Nitrogen compression will also be demonstrated once the concept is proven for oxygen. The Phase I results will provide preliminary design information for a working prototype SEC/Joule-Thomson cooling system in Phase II. The ultimate results of this research will be the development of cooling systems based on the solid electrolyte compressor for space applications.

MARKO MATERIALS, INC.
PO BOX 3, 19-1 STERLING ROAD
NORTH BILLERICA, MA 01862
Phone: (508) 663-2210
Topic#: 91-013 ID#: 91-143
Office: NSWC
Contract #: N00014-91-C-0211
PI: Dr. Ranjan Ray

Title: Molybdenum Disilicide Matrix Composites Reinforced with Microparticulate Titanium Carbide

Abstract: Molybdenum Disilicide (MoSiE2) based intermetallic materials have proven to be rather formidable materials to process because of their extreme brittleness and poor fracture toughness at low temperature. Another drawback of these materials is their insufficient creep strength at high temperatures. The proposed research focuses on preparation of MoSiE2 base composites reinforced with a high volume fraction of ultrafine particles of hard refractory titanium carbide uniformly dispersed throughout the matrix via a rapid solidification-melt spinning technique. MoSiE2 alloy containing TiC will be prepared as rapidly solidified (RS) powders. RS powders will be composited with a 3D-network of niobium wire (15%). The ductile Nb wire is anticipated to improve fracture toughness of MoSiE2 matrix composites by the crack bridging and crack blunting mechanism. The ultrafine RiC dispersoids will lead to improved creep strength by obstructing dislocation motions, and pinning dislocations/grain boundaries. Composite materials will be characterized for high temperature creep strength and low temperature fracture toughness properties. Microstructure of MoSiE2 matrix composites will be investigated by the SEM and TEM techniques.

MATERIALS TECHNOLOGIES CORP.
57 MARYANNE DRIVE
MONROE, CT 06468
Phone: (203) 261-5200
Topic#: 91-011 ID#: 91-610
Office: AF
Contract #: F49620-91-C-0003
PI: Dr. John N. Pike

Title: Enhanced Quantum Dot Nonlinear Optical Materials

Abstract: The quantum dot semiconductors, the subject of this proposal, are a new class of nonlinear optical materials which offer considerable promise for the fabrication of novel nonlinear optical composites and resulting device. The filter glasses (a subset of this class of materials) are now well known but the prospects for molecular engineering to modify the particles and/or their surfaces to improve their properties are limited. Our proposal employees this approach. Materials Technologies Corp will investigate the preparation of a new class of nonlinear optical composite where a nonlinear particle is embedded and bonded directly into a nonlinear optical host. It is expected that the synergy resulting from such as microstructure will result in a composite with superior nonlinear optical properties. The concept will be critically examined via cadmium sulfide/polydiacetylene system. Applications include: optical signal processing (switches, modulators, and waveguide devices); image processing, image understanding and image storage; real time (dynamic) holography for reconfigurable interconnects and networks.

MCMAHAN ELECTRO-OPTICS, INC.
PO BOX 14026, 79 T.W. ALEXANDER DRIVE
RESEARCH TRIANGLE, NC 27709
Phone: (919) 549-7575
Topic#: 91-003 ID#: 91-358
Office: AF
Contract #: F08630-91-C-0049
PI: Dr. Robert K. McMahan, Jr

Title: Sensor Fusion and Target Recognition/Discrimination System

Abstract: Phase I will design a decision making system to integrate sensor and electronic support measures information. The concepts of neural networks, fuzzy systems, and expert systems will be formalized in terms of the specific problem resulting in a determination of the appropriate technology for each piece of the decision making process; non-traditional technologies will be prototyped and tested against their counterparts from the traditional technologies will be prototyped and tested against their counterparts from the traditional technology area. Conventional approaches will be analayzed to determine a preliminary set of processing strategies. The final system will be designed to fuse information at both the signal level and the symbolic level. Phase I will result in a Phase II brassboard design specification.

METROLASER
18006 SKYPARK CIRCLE, #108
IRVINE, CA 92714
Phone: (714) 553-0688
Topic#: 91-003 ID#: 91-276
Office: SDC
Contract #: DASG60-91-C-0078
PI: Cecil F. Hess

Title: Programmable, Particle Sizing Sensor

Abstract: Particle contaminants affect the performance of space platforms. These particles are expected to range between 0.5um and 10um in diameter and their concentration and composition may be diverse and unknown. A particle sizing instrument is being developed to determine the size and space distribution of this ill-defined particle cloud. A 45 mW diode laser is used to make a light weight instrument which correlates scattered light to particle size. By collecting forward scattered light, the signal is dependent only on particle size over a broad range of refractive indices (insensitive to material type) and different particle shapes. A variable aperture allows adapting the probe area to optimize instrument performance for a given particle concentration. Software developed at MetroLaser avoids the dead time found in other instruments of this type, thus preventing the loss of data. The final design will be a light weight compact instrument which is adaptive to the unknown space environment.

MICROSCIENCE, INC.
41 ACCORD PARK DRIVE
NORWELL, MA 02061
Phone: (617) 871-0308

Topic#: 91-015 ID#: 91-181
Office: SDC
Contract #: DASG60-91-C-0097
PI: Dr. Charles Lok

Title: Metalorganic Chemical Vapor Deposition of Superconductive Thin Films by Electron Cyclotron Resonance Plasma Enhanced Chemical

Abstract: Electron Cyclotron Resonance Plasma Enhanced Chemical Vapor Deposition (ECR-PECVD) technique can deposit uniformly Yttrium-Barium-Copper type high temperature superconducting thin film over a large area about 6 inches in diameter. To maintain the superconductivity on the surface and the bulk of the thin film, high oxygen content must be retained on the film. ECR technique can sustain an oxygen rich environment. Further, as the electron temperature ranges from 7 to 15 eV in the ECR source, it provides an environment for the chemical reaction between Y, Ba, and Cu metal chelates and oxygen atoms forming high temperature superconducting materials in the plasma. Microscience will create plasma in the ECR source, and extract plasma to the process chamber by a divergent magnetic field. This stream of uniform plasma containing superconductive precursors will bombard the heated surface of the substrate, say YSZ(100), forming a thin film. The as-deposited thin film will be investigated whether high temperature superconductive thin film is formed. This deposition process can be applied to fabricated thin film layers on water.

MRAM, INC.
16 BOSTON POST ROAD
WAYLAND, MA 01778
Phone: (508) 358-1005

Topic#: 91-011 ID#: 91-158
Office: ONR
Contract #: N00014-91-C-0152
PI: Gary J. Spletter

Title: Parallel 3-D Magnetic Resonant Address Memory

Abstract: Parallel processor systems are acclaimed for supercomputing. All parallel systems require true parallel access memories (no interleaving) for efficient parallelism. MRAM has invented the first true parallel memory. As a result of this breakthrough in cost/performance, parallel systems can now span the full market range, from large supercomputers to PCs. This parallel RAM uses electromagnetic RF waves that are transmitted to/from the media (memory material). Data bits are written and read by frequency tuning, thus parallel access is achieved as a result of the parallel nature of electromagnetic radiation. The memory uses the principle of nuclear magnetic resonance (NMR). A fortunate discovery of a unique material was critical to the development of this memory. The material is inexpensive, and stores a megabit of data per cubic centimeter. The memory reads at the rate of 20 megabits per second, and writes at 4 megabits per second, with an access time of 50 and 250 nanoseconds respectively.

MRJ, INC.
10455 WHITE GRANITE DRIVE
OAKTON, VA 22124
Phone: (703) 385-0792

Topic#: 91-012 ID#: 91-405
Office: AF
Contract #: F29601-91-C-0062
PI: Rong C. Shieh

Title: Massively Parallel Computer Based, Analytical Predictive Techniques for Control/Structure Interaction Analysis

Abstract: The purpose of this research project is to identify and/or formulate efficient methods and associated computational algorithms for predicting the dynamic performance and stability characteristics of control augmented, damping enhanced, large space structures in a massive data parallel environment. It is assumed that the structures are to act in concert with on-board

distributed controllers as well as discrete controllers for maneuvering, pointing, and vibration or noise suppression. The displacement finite element methods will be used in developing piezoelectrically controlled beam and truss finite element models and formulating the discretized equations of motion that govern the stability and dynamic responses of the coupled control/structures system. Both "direct" and "modal" solution techniques will be used in solving the nonproportionally damped, nonconservatively loaded stability and dynamic response problems. In Phase I, efficient analysis methods and solution algorithms will be identified and/or formulated and a selected subset of these algorithms implemented in the massively parallel Connection Machine CM-2 model computer. Full implementation of a set of promising algorithms on CM-2 computer will be given in Phase II.

NEOCERA, INC.
100 JERSEY AVENUE, BUILDING D, BOX D-12
NEW BRUNSWICK, NJ 08901
Phone: (609) 734-2629
Topic#: 91-015 ID#: 91-570
Office: AF
Contract #: F19628-91-C-0126
PI: Erwin Belohoubek
Title: Superconducting Non-Reciprocal Devices for Microwave Systems
Abstract: High temperature superconducting microwave passive components promise to shrink by one to two orders of magnitude, while lowering their losses. Superconducting filter structures, delay lines and high-Q resonators already have been demonstrated from L- through K-band at temperatures up to 80K. Real systems advantages are expected from the integration of such components into a compact subsystem that justifies the additional cooling. A key component in most practical microwave systems is the non-reciprocal device in the form of a circular or isolator. This SBIR will show the feasibility of such devices using superconducting thin films in a minimum volume and with minimum loss. The ultimate goal is the integration on a common garnet substance.

NIMBLE COMPUTER CORP.
16231 MEADOW RIDGE WAY
ENCINO, CA 91436
Phone: (818) 501-4956
Topic#: 91-010 ID#: 91-482
Office: SDC
Contract #: DASG60-91-C-0099
PI: Henry G. Baker, PhD
Title: Optimistic Scheduling of Non-Numeric Tasks on Highly Parallel Processor Architectures
Abstract: Objective: to develop improved techniques and algorithms for the optimistic execution of large-scale symbolic computations on highly parallel multiprocessors. Phase I will explore the feasibility of automatically scheduling mandatory and speculative tasks using information gained from both compile-time and concurrent run-time strictness analyses, which perform concurrent means-end analyses on tasks. We will also investigate the automatic building of concurrently running resource consumption models, which can provide even more information about the time and space requirements of sub-tasks. The techniques and algorithms developed in Phase II can be extended, prototyped and measured on a MIMD processor in Phase II. A successful project can provide dramatic performance gains in many parallel symbolic computations, as a result of shorter time-to-result due to improved scheduling.

NORTH EAST SEMICONDUCTOR, INC.
767 WARREN ROAD
ITHACA, NY 14850
Phone: (607) 257-8827
Topic#: 91-014 ID#: 91-374
Office: ARO
Contract #: DAAL03-91-C-0031
PI: Michael S. Frost
Title: Strained AlGaInAs Semiconducting Material
Abstract: AlGaAs laser diode arrays used at 785-808 nm to pump YAG-type solid state lasers need improvement in reliability and power efficiency. Diode lasers with InGaAs quantum wells, used for longer wavelength pumping, have demonstrated improved life and efficiency. This program will study the quaternary material system, AlxGaylnAs, to determining growth conditions which can result in highly reliable diode lasers emitting light at ^ < 850 nm. The program will use MBE grown multiple quantum well structures and photoluminescence diagnostics to efficiently explore a wide range of compositions, growth temperatures and fluxes. These data will be used to design and build laser diodes to demonstrate lifetimes and power efficiencies.

NORTHEAST PHOTOSCIENCES
18 FLAGG ROAD
HOLLIS, NH 03049
Phone: (603) 465-3361
Topic#: 91-005 ID#: 91-152
Office: AF
Contract #: F33615-91-C-2136
PI: Jacques Ludman
Title: Photovoltaic Systems Based on Spectrally Selective Concentrators
Abstract: We have developed a holographic device that greatly improves the efficiency of solar energy generation. The single-element hologram focuses light to the side and also spectrally splits it. The output appears as a thin, concentrated line focus perpendicular to the hologram and displaced to the side. Different wavelengths are diffracted, concentrated, and dispersed to different locations on the line. The line resembles an elegant rainbow in the visible. The hologram lets each of two or more different solar cells absorb only those wavelengths that it can efficiently convert to electric power. The device also prevents overheating by diffracting unwanted infrared away from the cells. The side focus eliminates shadow effects, and cooling is easy, since the cells are not cascaded and the heat load is minimal. This novel system is ideal for concentrating, spectrum splitting, high efficiency power generation.

NOVA ELECTRONICS & SOFTWARE
1525 THIRD STREET, #A201
RIVERSIDE, CA 92507
Phone: (714) 781-7332
Topic#: 91-003 ID#: 91-390
Office: SDC
Contract #: DASG60-91-C-0112
PI: Dr. Tumay O. Tumer
Title: Wide Aperture, High Angular and Energy Resolution Imaging Gamma Ray Detector
Abstract: A novel wide aperture high angular and energy resolution imaging detector for 0.3 to 30 MeV gamma rays has good potential for space-based ballistic missile defense system. It can also detect other space-borne objects or satellites which carry radioactive material such as satellites with nuclear power sources. This detector will have a high angular resolution of about 1 degree and source direction measurement better than +0.1 degree. Such detectors with wide aperture are not yet available. The high angular resolution and wide aperture (approx. 120 degrees) will enable excellent imaging of space objects in real time. Good energy resolution of about 5% at 1 MeV will enable good energy spectrum determination for the identification of the radioactive contents of the space objects or nature of the events. High sensitivity will enable the detection of very weak sources, or distant objects. The detector can be easily scaled up or down in size to adjust its sensitivity to match the source strength. It will have on-board real time data analysis and imaging hardware and software for instantaneous detection and reporting of space objects carrying nuclear weapons. Preliminary Monte Carlo calculations show high sensitivity and excellent angular and energy resolutions for 0.3 to 30 MeV gamma rays.

OPTICAL CONCEPTS RESEARCH
1240 AVENIDA ACASO
CAMARILLO, CA 93010
Phone: (805) 733-4299
Topic#: 91-011 ID#: 91-539
Office: ARO
Contract #: DAAL03-91-C-0032
PI: M. Kevin Kilcoyne
Title: Surface Emitting Laser and Asymmetric Fabry-Perot Modulator Arrays
Abstract: This proposal explores the use of surface emitting laser (SEL) arrays in conjunction with surface normal asymmetric Fabry-Perot modulators and integrated photodetectors for application in optical computing and optical signal processing. Surface emitting lasers have recently been developed at UC Santa Barbara with submilliampere thresholds and very high modulation rate capability. The low threshold and high operating efficiency make these lasers ideal for array applications in conjunction with Asymmetric Fabry-Perot surface normal reflection modulators. Up to this time, high speed, surface emitting laser arrays have not been technically feasible. The objective of the Phase I research is to design and evaluate the performance of SEL arrays. Because of the low voltage and low capacitance of these SELs, they are capable of operating at very high speeds, estimated to be 30 GHz or greater. By combining the SELs with ASFP modulator arrays (which can also function as detector arrays, and as optical logic elements), powerful optical signal processing systems are possible, with multichannel, multi-GHz performance at modest power and straightforward optical interfaces. Commercial and military applications include high bandwidth, multi-channel optical transmitter/receiver systems, reconfigurable optical interconnects, optical signal processing and optical computing.

ORA CORP.
301A HARRIS B. DATES DRIVE
ITHACA, NY 14850
Phone: (607) 277-2020
Topic#: 91-010 ID#: 91-471
Office: SDC
Contract #: DASG60-91-C-0019
PI: Ian Sutherland
Title: A Secure Fault Tolerant Reference Monitor
Abstract: The goal of the project is to develop a formally verified design for a multilevel secure, distributed, fault tolerant reference monitor. A reference monitor is a system program which controls access of user processes to sensitive data. The reference monitor checks accesses for compliance with a system security policy, and disallows accesses not in compliance. ORA will develop a design for a reference monitor which is distributed on multiple processors and can tolerate processor and memory faults. The project will define a formal mathematical model of security for the reference monitor. The design will be formal language and verified to satisfy the security model in a verification environment built at ORA called Romulus.

PHOTONICS TECHNOLOGIES
1019 PARKLAND PLACE, SE
ALBUQUERQUE, NM 87108
Phone: (505) 262-1705
Topic#: 91-011 ID#: 91-189
Office: AF
Contract #: F3602-91-C-0137
PI: Dr. G. R. Olbright
Title: Surface-Emitting Laser Logic for Digital Optical Computing
Abstract: Digital optical computing has evolved to the point where viable architectures have been described in detail. Hundreds of papers are published and several topical conferences are held annually on the subject. However, few demonstrations have been reported of actual operating systems due to the unavailability of an "ideal" optical logic gate having: optical gain, cascadability, high on/off contrast, the appropriate two-dimensional geometry and NxN pixel densities, adequate switching speeds, and tolerable switching power requirements. Clearly, architecture design has outpaced device development. In this proposal we described a revolutionary new device which will meet all of the above device requirements. We call it a surfaCe-Emitting Laser Logic (CELL) device. The device consists of a vertical-cavity surface-emitting laser monolithically integrated with a phototransistor. The CELLs are cascadable; have high optical gain (large fan out capability);function naturally to perform a Boolean digital optical logic; can be fabricated using simple two-dimensional planar VLSI technology and emit light perpendicular to the surface. The Phase I project will: demonstrate a cascadable, high-gain CELL; design an optimized second generation CELL; design a digital optical switching array; and outline Phase II. Phase II will entail the demonstration of a working digital optical logic array and subsequently a digital optical computing processor.

PHYSICAL OPTICS CORP.
20600 GRAMERCY PLACE, SUITE 103
TORRANCE, CA 90501
Phone: (213) 530-1416
Topic#: 91-011 ID#: 91-361
Office: AF
Contract #: F08630-91-C-0045
PI: Michael Wang
Title: Electro-Optic Analog-to-Digital Converter Modulator
Abstract: We will develop entirely new class of electrooptic analog-to-digital (A/D) converters and modulators. Preliminary experiments on electrooptic materials have demonstrated such conversion/modulation. The A/D converter/modulator consists of an integrated optic channel waveguide with device end faces polished and coated with high reflectivity mirrors. The resultant transmission response of the device can be tuned through the electrooptic effect. Several advantages of the A/D converter/modulator are its multi-valued logical capability, electronically reconfigurable logical weights, and high speed operation (~GHz). Additional advantages include elimination of the use of sampling optical pulse, provision of long distance digital optical signal tranmission capability, high SNR, high dynamic range and thermal stability. The reconfigurable multiwavelength coding can be used to realize highly secure optical communication for military an commercial purposes.

PHYSICAL OPTICS CORP.
20600 GRAMERCY PLACE, SUITE 103
TORRANCE, CA 90501
Phone: (213) 320-3088
Topic#: 91-014 ID#: 91-362
Office: ARO
Contract #: DAAL03-91-C-0030
PI: Ray T. Chen, PhD
Title: Microprism Array for Large-Scale, Wideband Interconnection of Optoelectric Systems
Abstract: Microprism arrays on high-index glass (n=1.7-1.9) with linear dimensions as small as 10E-4 have been made and

demonstrated for wide-band large-scale interconnection. A board-to-board optical interconnection with 60 GHz modulation bandwidth and 22 dB signal-to-noise ratio is achieved using microprism couplers in conjunction with optical buses. A coupling bandwidth of more than 250 nm has been confirmed, which is two orders of magnitude higher than that for holographic grating couplers. Elimination of backplane interconnection greatly enhances the interconnection speed and reduces the clock skew. Implementation of a high-speed on-board transceiver will generate a fully on-board high-speed processor. Microprism arrays are mass producible. A miniaturized fine-grained 3-D computer can be realized where each microprism coupler will cost only ten cents in large quantities.

POSITECH, INC.
125 OAKLAND DRIVE
PIEDMONT, SC 29673
Phone: (803) 947-9378
Topic#: 91-010 ID#: 91-596
Office: SDC
Contract #: DASG60-91-C-0073
PI: John Fury Christ
Title: Neural Network Solution to the Weapon-to-Target Assignment Problem
Abstract: Preliminary research has shown that a neural network can solve the weapon-to-target assignment (WTA) problem -- a computationally intractable problem. The network, simulated on a low cost parallel processor in a PC host, has produced the best quality and fastest solutions to a realistic threat scenario published to date. This application, employing more than 46,000 neurons having more than 49 million interconnections, is among the largest neural networks ever studied and requires only 8 seconds for convergence. A study is underway that on performance on much larger scenarios, exploring the use of genetic algorithms to better solution quality, extending WTA to accommodate more complicated threat scenarios, and demonstrating the performance of the neural network using a high performance, low cost, neural network accelerator.

PRINCETON X-RAY LASER, INC.
1-H DEER PARK DRIVE
MONMOUTH JUNCTION, NJ 08852
Phone: (908) 329-0505
Topic#: 91-001 ID#: 91-233
Office: NRL
Contract #: NOOO14-91-C-2241
PI: Dong-Eon Kim
Title: Soft X-Ray Laser
Abstract: Brightness is one of the most important properties of the novel X-ray sources, and the X-ray laser is the brightest X-ray source available. These bright X-ray sources are rapidly becoming the technological base to address new needs of diverse markets, which include the microscopy of live specimens with previously unachievable details (30 nm) and high resolution (better than 100 nm) lithography for the manufacture of high density integrated circuits, and testing and inspection of lithographic processes. Based on the X-ray laser developed at Princeton University (PXL, Inc.'s executive license) PXL is now developing a desk-top X-ray laser capable of delivering short (nanoseconds) pulses of extremely bright coherent nearly parallel X-ray photon beams. This PXK product will make the brightest X-ray source and high resolution nondestructive microscopy available for "small-science" settings, and industrial and clinical facilities at low cost.

QSOURCE, INC.
239 BURNHAM STREET
EAST HARTFORD, CT 06108
Phone: (203) 291-0120
Topic#: 91-003 ID#: 91-155
Office: ONR
Contract #: N00014-91-C-0154
PI: Peter P. Chenausky
Title: Sealed-off, High PRF CO2 Transmitter
Abstract: SDIO's general mission is finding and disabling ballistic missiles in flight. Range-doppler lidars are a known means by which missiles can be found. The innovative lidar transmitter proposed here uses a proprietary discharge excitation technique that results in a much smaller, lighter and longer lived COE2 transmitter because no gas recirculator is required even at high PRF's and can generate two consecutive short laser pulses separated by a time interval short enough to yield range, range rate or range doppler information on a ballistic missile. No present technology approach can meet these demanding mission requirements in a compact nonrecirculating configuration. The anticipated benefits of a successful program would be a COE2 transmitter that could be integrated with an airborne IRS&T system to reduce the system false alarm rate, used in a compact rangefinder system.

QSOURCE, INC.
239 BURNHAM STREET
EAST HARTFORD, CT 06108
Phone: (203) 291-0120
Topic#: 91-003 ID#: 91-176
Office: SDC
Contract #: DASG60-91-C-0069
PI: Peter P. Chenausky
Title: Wideband, Tunable Laser Oscillator
Abstract: Depending on the particulars of an engagement scenario, doppler shifts due to the relative motion of a missile and a sensor platform can be in excess of 1000 MHz for a coherent COE2 sensor system. Since the response of the sensor's heterodyne detector can be degraded by as much as 50% at these large offset frequencies, a local oscillator capable of being tuned either up or down 1000 MHz to compensate for this relative motion would be equivalent to increasing the sensor's laser transmitter power by a factor of two. Because a coherent COE2 sensor system already has a LO, any improvement in system performance afforded by an improved LO would be accomplished without altering the system weight, size or power budget. Two separate innovations, one in resonator design and another in discharge excitation are proposed to achieve a Phase I goal of 100 mW of sealed-off cw laser output power at 1500 MHz from laser line center.

QUANTUM EPITAXIAL DESIGNS, INC.
115 RESEARCH DRIVE
BETHLEHEM, PA 18015
Phone: (215) 861-6930
Topic#: 91-014 ID#: 91-495
Office: SDC
Contract #: DASG60-91-C-0076
PI: Thomas Hierl
Title: Planar Doped Pseudomorphic High Electronic Mobility Transistor Development
Abstract: The most promising material system to meet the performance criteria for low noise and power devices operating at millimeterwave frequencies is the planar doped Pseudomorphic High Electron Mobility Transistor. With MMIC processing compatibility with standard AlGaAs/GaAs HEMTs, this material system has potential for rapid insertion into millimeter-wave satellite based communication systems. For power applications, the addition of the planar doped layer increases the current handling capability and therefore increases the power density of the device. Phase I of this program will optimize the location and planar sheet charge layer of the single planar doped and double planar doped HEMT materials. To increase the carrier confinement in fabricated devices, AlAs/GaAs superlattice and low temperature buffer layers will be developed and tested. Once the effects of these buffer layers are known on the transport properties in the 2DEG, 0.25 micron gate low noise devices will be fabricated by the Hughes Microwave Products Division where the effects of the improved material quality will be evaluated. Successful completion of this program will identify the location of the planar sheet charge layers and optimum buffer layer profile that will yield the lowest noise devices.

QUEST INTEGRATED, INC.
21414 68TH AVENUE SOUTH
KENT, WA 98032
Phone: (206) 872-9500
Topic#: 91-013 ID#: 91-071
Office: SDC
Contract #: DASG60-91-C-0096
PI: Dr. Jack J. Kolle
Title: Optical Fiber Jet Placement for Triaxial Reinforcement/Delamination Monitoring of Composites
Abstract: Composite laminates may improve aerospace structures, if the composites don't delaminate. Delaminations result in unpredictable strength and stiffness reductions and are difficult to detect. This project places triaxial arrays of optical glass fiber in laminates. When delamination occurs, the optical fibers break and the delamination can be detected by simple optical inspection. The fibers also reduce the incidence of delamination. The optical fibers are placed in uncured laminates by high speed impact. Development of a simple technique for placing triaxial reinforcement and for in-service inspection of composite laminates will have a major impact on the acceptance of composites for use in critical aerospace structures.

RANTECH COMPANY
805 W. DUARTE ROAD, SUITE 102
ARCADIA, CA 91007
Phone: (818) 574-8782
Topic#: 91-011 ID#: 91-249
Office: NOSC
Contract #: N66001-91-C-7019
PI: Dr. Albert Stiegman
Title: Asymmetric Glasses via a Sol-Gel Process
Abstract: RANTECH will investigate an approach to increase size, efficiency and processability of second-order NLO materials by utilizing an innovative sol-gel process. Specifically, RANTECH proposes to align and lock inorganic chromophores in a

silica glass which is both processable and scalable into larger sizes. In this approach, covalent bonding and rigidity of the inorganic glass matrix will prevent relaxation of the aligned inorganic chromophores. Using inorganic alkoxides which are well known second-order NLO chromophores, enables the densification of the inorganic glass at elevated temperatures which were previously inaccessible due to the thermal instability of the organic chromophores being used.

RASOR ASSOCIATES, INC.
253 HUMBOLDT COURT
SUNNYVALE, CA 94089
Phone: (408) 734-1622

Topic#: 91-004 ID#: 91-475
Office: AF
Contract #: F29601-91-C-0068
PI: Dr. G. L. Hatch

Title: Analytical Characterization of Test Cells and Optimization Using Mixed Vapors

Abstract: By use of cesium-oxygen mixed vapors (Cs/O) it may be possible to as much as double the output power and efficiency of thermionic fuel elements and the associated space nuclear power systems. In Phase I of this research, the electrical and thermal operating characteristics of the USSR TOPAZ core-length TFEs and similar US TFE designs are analytically modeled using the TECMDL computer program. This model, together with the COAD Cs/O coadsorption computer program, is used to evaluate the potential improvement in TFE performance by use of Cs/O. A Cs/O source is designed for proof-of-principle TFE tests in Phase II.

RETICULAR SYSTEMS, INC.
4095 CALGARY AVENUE
SAN DIEGO, CA 92122
Phone: (619) 457-0709

Topic#: 91-010 ID#: 91-486
Office: ONR
Contract #: N00014-9-1-C-0097
PI: Dan R. Ballard

Title: Very Large Knowledge Base Processing Architecture

Abstract: Imagine a doctor's office in 2005 where computers serve as "mechanical doctors" who won't get tired or forget you and who take time to be compassionate during diagnosis. Affordable, consistent, quality medical care would be available for everyone. How? These "mechanical doctors" would also process the million pieces of background and common-sense knowledge we take for granted. Today's computers and programs cannot. Reticular Systems Inc., is developing Very Large Knowledge Base products needed to process specific expertise, background and common-sense knowledge. VLKBs will be built from smaller or existing knowledge bases. "Intelligent agents" will reason across multiple knowledge bases and will be programmed to know how the knowledge bases were developed, their inter-relationships, and how problems are solved within the specific profession. The number of potential users is enormous: pilots, battlefield commanders, air traffic controllers, stock brokers, doctors, and taxpayers will be assisted in making difficult decisions in a complex, swiftly changing world.

REVEO, INC.
200 SAW MILL RIVER ROAD
HAWTHORNE, NY 10570
Phone: (914) 741-2006

Topic#: 91-014 ID#: 91-630
Office: ONR
Contract #: N00014-91-C-0149
PI: Sadeg M. Faris, PhD

Title: 3-D Stereo Displays for Advanced Workstations

Abstract: Powerful workstations can handle complex problems which usually involve 3-D objects, demanding sophisticated graphics for analysis and visualization. Future image processors and graphic user interfaces will inevitably include 3-D stereo output devices (displays and printers) compatible with the human stereoscopic vision. The state-of-the art 3-D stereo display technology is based on liquid crystal shutters and works by sequentially presenting to the user polarization coded left and right perspectives of the object. This field sequential method has several limitations which include: i.) to avoid flicker it requires doubling the frame frequency, making it incompatible with the most display devices and standard video equipment; and ii.) it is intrinsically incapable of producing hard copy color output prints or plots. Under this contract Reveo will develop a unique and innovative 3-D stereo display technology which overcomes the limitations of the field sequential methods, on a new passive element called the micro-polarizer array, and spatial multiplexing, instead of time multiplexing. Phase I is to investigate the compatibility of the micro-polarizer technology with existing display devices and deliver a 3-D stereo display design. Phase II deliver a prototype 3-D stereo display that may be introduced to market after Phase III.

RTS LABORATORIES, INC.
1663 TECHNOLOGY AVENUE
ALACHUA, FL 32615
Phone: (904) 462-2666
Topic#: 91-004 ID#: 91-292
Office: NASA
Contract #: NAS3-91-C-26318
PI: Richard T. Scheider
Title: Uranium Arc Fission Reactor
Abstract: Uranium arc technology is being developed for space nuclear thermal and electric propulsion reactors where the arc is driven mainly by fission energy and requires little electrical energy input. It operates at 10,000K, and transfers its energy to the propellant or working fluid via optical radiator. The propulsion turbocharger or afterburner can elevate fluid temperatures to levels above the melting point of any material (above 4000K), which brings very high specific impulse propulsion or ultrahigh temperature power conversion. For space power platforms, the resultant improved efficiency means reduced and easier waste heat rejection and thus a more compact, lower mass reactor design. The technology is also applicable for more efficient and safer ground-based electric power generation. A spinoff development is the technology for handling uranium and its compounds in liquid and vapor forms.

SAN JUAN TECHNOLOGIES
809 COPPER NW, SUITE 200
ALBUQUERQUE, NM 87102
Phone: (719) 599-5471
Topic#: 91-013 ID#: 91-041
Office: NSWC
Contract #: N60921-91-C-0259
PI: John C. Schneider
Title: Low Cost Structural Ceramic Composites
Abstract: The objectives of this contract are to apply innovative concepts to low temperature formation of advanced high temperature materials and then integrate these concepts into low cost manufacturing processes. The composites are formed as net shapes or as coatings. Control is achieved at the nanometer scale through atomic deposition and thermally activated reaction bonding. Several processes are under test with initial results showing excellent promise for meeting program objectives. Government and industrial applications include: aerospace and power structures; thermal management; internal combustion engine components; radar and EMI shielding and reflection control; abrasion and frictional wear resistance; corrosion resistance; composite media for exhaust and catalytic filters;power generation components; prosthetics and prosthodontics; rubber and plastic mold coatings; and textile machine guide coatings.

SATCON TECHNOLOGY CORP.
12 EMILY STREET
CAMBRIDGE, MA 02139
Phone: (617) 661-0540
Topic#: 91-012 ID#: 91-582
Office: CERL
Contract #: DACA88-91-C-0005
PI: James H. Goldie
Title: Eddy Current-Based Vibration Damping for Aerospace Structures
Abstract: SatCon has developed an eddy current-based vibration damper ready to advance disc drives, home audio and video equipment, vibration isolation systems for industry and instrumentation, and even automobile suspensions. These dampers are remarkable for their linearity, reliability, wide range of operating temperatures,and their space environment compatibility. SatCon has established design guidelines which ensure dampers with linearity and maximum vibrational energy per unit damper mass. The result is a set of practical damper designs which can prevent vibra-acoustic fatigue in aircraft, suppress vibration in a space truss structure, or provide damping for vibration isolation. The noncontracting nature, the absence of wear and suction, and the exceptional low temperature performance suggest their use in a wide range of critical and demanding applications from cryogenic to noise quieting to precision pointing and positioning.

SCHMIDT INSTRUMENTS, INC.
2476 BOLSOVER, SUITE 234
HOUSTON, TX 77005
Phone: (713) 523-7119
Topic#: 91-003 ID#: 91-536
Office: AF
Contract #: F33615-91-C-1732
PI: Keith Jamison
Title: Voltage Tunable Multi-Spectral Infrared Sensor
Abstract: Schmidt Instruments proposes to develop a novel tunable photodetector based on a double barrier photon assisted resonant tunneling structure. The device can be fabricated from a number of semiconductor systems depending on the detector characteristics one desires. For example, a detector based on the GaAs/AlGaAs system would be capable of detecting photons

with energies throughout the infrared spectrum (2m-25m). The tunability of this device enables multi-spectral response by time division multiplexing. Feasibility of a two-color detector operating in the 5m-15m wavelength range fabricated from the GaAs/AlGaAs materials system will be demonstrated in the Phase I program. The device will be optimized in the early stages of the second phase. A two-dimensional, voltage tunable two color, small element array (64x64) detector capable of operation between 3m-15m will be produced in Phase II.

SCIENCE RESEARCH LABORATORY, INC.
15 WARD STREET
SOMERVILLE, MA 02143
Phone: (617) 547-1122
Topic#: 91-001 ID#: 91-030
Office: ONR
Contract #: N62269-92-C-0507
PI: Dr. Jonah Jacob
Title: Electrodeless Potassium Flashlamps for Pumping ND:YAG Lasers
Abstract: This SBIR program will develop a revolutionary low cost electrodeless flashlamp technology that can efficiently couple radiation to the pump bands of Nd:YAG lasers. This new flashlamp technology will increase the overall efficiency of Nd:YAG lasers by a factor of 5 to 10 over the achievable with the present xenon flashlamps, extend flashlamp life factor to greater than or equal to 10E9 shots and reduce the cost of efficient solid-state laser pump sources thereby making these lasers affordable for the end users in both the government and the commercial sector. Specifically electrodeless alkali vapor flashlamp technology will be developed for efficiently pumping Nd:YAG lasers in both rod and slab configurations for space-based laser radar and laser communications. Long-lived, low cost, spectrally efficient alkali-vapor flashlamps can also be developed for pumping other solid state laser materials such as Ti-Sapphire and Alexandrite. In Phase I, a final engineering design for electrodeless potassium flashlamps will be generated by SRL computer Codes. In the Phase II effort, electrodeless, potassium-vapor flashlamps will be developed and tested and overall radiative efficiency into the pump bands of Nd:YAG will be measured.

SCIENCE RESEARCH LABORATORY, INC.
15 WARD STREET
SOMERVILLE, MA 02143
Phone: (617) 547-1122
Topic#: 91-003 ID#: 91-206
Office: AF
Contract #: F33615-91-C-1738
PI: Mr. Reich Watterson
Title: Efficient, Compact, Kilowatt-Class Nd:YAG Lasers with Subnanosecond Pulse Duration
Abstract: The objective of this SBIR program is to develop a new compact Nd:YAG slab laser amplifier architecture which increases laser efficiency and the extractable energy from a single laser slab by a factor of 1.6. In addition, implementation of chirped pulse amplification techniques in a nanosecond pulse regime can lead to the efficient generation of subnanosecond output pulses in a compact and efficient device with improved reliability by limiting peak fluence levels within the crystal. In the Phase I effort, a 20 GW peak, 150 Watt average power, diode-pumped Nd:YAG slab laser module will be designed which incorporates the new laser architecture and subnanosecond output pulse capability. Proof-of-principle experiments will also be designed in Phase I to validate these new Nd:YAG laser concepts. These validation experiments will then be conducted using a flashlamp-pumped head in the Phase II effort. This technology can be scaled to provide compact, lightweight, efficient 70 GW peak power, 500 Watt average power, diode pumped Nd:YAG lasers. The unique combination of 10 Joule single pulse energy, 100 picosecond pulse duration and high pulse repetition rates will permit high throughput with laser driven x-ray sources for sub-0.25 microsecond x-ray lithography and enhanced tracking rates for high resolution space-based laser radar.

SCIENTIFIC SYSTEMS, INC.
500 WEST CUMMINGS PARK, SUITE 3950
WOBURN, MA 01801
Phone: (617) 933-5355
Topic#: 91-010 ID#: 91-068
Office: ARO
Contract #: DAAL0-91-C-0039
PI: Dr. Shah Mahmood
Title: Battle Management Dynamic Resource Allocation using Decentralized Robust Control Theory
Abstract: The SDI Battle Management problem is a complex high dimensional dynamic stochastic resource allocation problem. Recent developments in decentralized robust control theory provide a means to addressing some of the important aspects of this problem. In this proposal, the higher level problem of deciding how many interceptors should be assigned to each threat sector to maximize the probability of survival of the essential defense elements is formulated as a Linear Exponential Gaussian Team (LEGT) decision problem. During Phase I, a decentralized robust solution to the LEGT problem will be implemented and tested on a simplified SDI simulation. The objective of Phase I research is to test the feasibility and benefits of solving the higher level

stochastic assignment problem using LEGT formulation. Phase II will address the lower level battle management decision problems and test the algorithms on a larger scale simulation of the SDI battle management scenario. The problem of controller reconfiguration after failure detection will also be considered.

SENSOR SYSTEMS GROUP, INC.
150 BEAR HILL ROAD
WALTHAM, MA 02154
Phone: (617) 890-0204

Topic#: 91-003 ID#: 91-591
Office: SDC
Contract #: DASG60-91-C-0119
PI: Michael I. Anapol

Title: Light Weight, Silicon Carbide, Multicolor Telescopes for Satellite Constellations

Abstract: Silicon carbide can replace toxic beryllium as a mirror. Light weight optical subsystems are so important to satellite-based sensor concepts that numerous operational system baselines identify a high-cost, single-supplier, toxic, moderately stable optical/structural materials: beryllium. Silicon carbide as the replacement material is an emerging technology which can revolutionize the optical industry. It offers the strength: weight ratio of beryllium with the imaging performance of glass at a cost less than aluminum. The SSG innovation pushes the silicon carbide optical and telescope fabrication technologies into those areas critical for Brilliant Pebbles, Brilliant Eyes, and TacSat/Lite Sat constellation concepts: finishing/stability/coatings for uv/visible levels; large scale producibility; transition to telescope assemblies. These accomplishments will be verified with multiple copies of optical components and complete telescopes representative of satellite constellation system concepts.

SIERRA MONOLITHICS, INC.
103 WEST TORRANCE BOULEVARD, SUITE 102
REDONDO BEACH, CA 90277
Phone: (213) 379-2005

Topic#: 91-015 ID#: 91-251
Office: AF
Contract #: F49620-91-C-0066
PI: Dave Rowe

Title: Josephson Junction Digital Waveform Generation

Abstract: Stable wide-band signal sources are key components in radar and communication systems. Ultra-wideband direct digital synthesis of complex waveforms using superconducting Josephson junction logic technology is proposed, projecting a ten-fold improvement in bandwidth over the current GaAs based direct digital synthesizers. The Phase I effort will include the optimization of the DDS architecture for implementation in superconducting technology, detailed circuit designs, system performance appraisal, packaging designs, and cooling.

SILICON ENGINES, INC.
955 COMMERCIAL STREET
PALO ALTO, CA 94303
Phone: (415) 424-0480

Topic#: 91-010 ID#: 91-442
Office: ONR
Contract #: N00014-91-C-0158
PI: Jerome F. Duluk

Title: General Purpose Content-Addressable Memory Subsystem

Abstract: This program will utilize a CAM (Content-Addressable Memory) chip in a memory option card for Sun workstations. This design will efficiently search and manipulate vector space data. The final system will be capable of performing over 1 trillion magnitude comparisons per second. The CAM searches spatially distributed data in an n-dimensional space and manipulates subsets of data within that space. The CAM chip contains 516 words, each including 32 data bits and 32 flag bits. Words can be split into a selectable number of fields, each treated as an integer for magnitude comparisons. In one bus cycle, all fields in all words in the system can be compared in magnitude to fields in an input data vector. Main applications of this system are: pattern recognition, circuit simulation event queuing, sparse distributed memory neural nets, VLSI place and route, sorting redundant target/trajectories from multiple sensors.

SILICON FILMS CORP.
9410 DE SOTO AVENUE, UNIT H
CHATSWORTH, CA 91311
Phone: (818) 700-1977

Topic#: 91-014 ID#: 91-010
Office: ONR
Contract #: N00014-91-C-0099
PI: S.C. Miller

Title: Superlattice Infrared Photo-Transistors Using Intersubband Transition

Abstract: Target detection and tracking in the wavelength range of 3 to 12 um with greatly increased sensitivity levels and spatial

resolution. The principle of the approach is based upon the inter-conduction subband (thereafter referred to as intersubband) absorption followed by photoexcited electrons tunneling out of resonantly aligned adjacent quantum wells. This process produces hot electrons and thus the photocurrent is efficiently collected. The detectivity of the AlxGa1-xAs/GaAs superlattice detectors is estimated D*8.3um=10E10/cm(Hz)1/2/W, comparable to typical background-limited HgCdTe photoconductive detectors. We will analyze theoretically the design and the performance of such transistor configurations. The approach proposed for fabrication of the superlattice photo-transistor uses the commercial available MBE material and simple laser interference patterning. If the concept is demonstrated, the production can be done readily.

SKW CORP.
1815 NORTH FT. MYER DRIVE, SUITE 1100
ARLINGTON, VA 22209
Phone: (714) 361-5660
Topic#: 91-003 ID#: 91-498
Office: SDC
Contract #: DASG60-91-C-0077
PI: Scott Evans
Title: Uncooled Infrared Focal Plane Arrays By Use of Non-Contact Electrical Interconnect
Abstract: Phase I demonstrated the feasibility of using non-contact electrical interconnects to eliminate indium bump bonds in uncooled infrared focal plane arrays (IRFAs). Results indicate a factor of 80000 improvement in response for a typical pyroelectric detector (50um x 50um x 50um lithium tantalate) and performance analyses show that noise equivalent temperature differences (NEDTs) less than .01K can be achieved. This technology can also be used in other IRFPA applications, such as improved peg 64K of cryogenically cooled IRFPAs by operation of the detector and readout and different temperatures, increased radiation hardness, improved yield and reliability by elimination of thermal expansion stress and delamination, a means of non-destructive detector array testing, and a low cost, mass producible generic readout.

SONOSCAN, INC.
530 EAST GREEN STREET
BENSENVILLE, IL 60106
Phone: (708) 766-7088
Topic#: 91-013 ID#: 91-157
Office: NSWC
Contract #: N60921-91-C-0131
PI: Albert Wey, PhD
Title: Real-Time NDE Using Multi-Function Robotic Sonoscope
Abstract: Manufacturing requires real-time evaluation of materials to determine structural properties, including inspection for latent defects. Current off-line evaluation techniques utilize special facilities and increase costs. This project develops a Multi-Function Robotic Sonoscope (MFRS) for on-line inspection. MFRS is a general purpose NDE tool. It uses a scanning laser beam for inspecting surface anomalies, produces C-Scan acoustic images to detect subsurface flaws, uses spectral analysis for characterization of material properties, and produces real-time through transmission acoustic images for on-line inspection. MFRS can be used to inspect internal defects such as delaminations, inclusions, voids, and porosity in metals, ceramics, composites, and electronic materials. It is also useful for nondestructive inspection of fatigue cracks and impact damage in structural composite materials.

SPACE POWER, INC.
621 RIVER OAKS PARKWAY
SAN JOSE, CA 95134
Phone: (408) 434-9500
Topic#: 91-014 ID#: 91-450
Office: ARO
Contract #: DAAL0-92-C-0003
PI: John L. Lawless
Title: Tunable Solid State Laser Material
Abstract: Space Power, Inc. will use a solid-state laser to cover the wavelength range from near IR through visible to near UV using a laser-type doped silica sol-gel. Materials temperature limitations previously prevented the doping of organic dyes in inorganic solids. The sol-gel technique solves this problem. The resulting material has potential advantages over liquid-based dye lasers while maintaining their tunability and flexibility. There is evidence that solid-state dye lasers will be more efficient and have longer life than liquid dye lasers. Sol-gel also has far better thermooptic properties. The advantages over other silica fabrication methods are: production of silica gels at low temperature, and enable fabrication of pure and homogeneous samples.

SPIRE CORP.
PATRIOTS PARK
BEDFORD, MA 01730
Phone: (617) 275-6000
Topic#: 91-014 ID#: 91-103
Office: ARO
Contract #: DAAL03-91-C-0033
PI: Fereydoon Namavar, ScD
Title: SiGe and Si Quantum Wires for Room Temperature Tunable Luminescence
Abstract: Phase I work has resulted in the fabrication of the first all-solid-state pn heterojunction porous Si LED capable of visible light emission at room temperature. A p-type Si wafer was anodically etched in an ethonic hydrofluric acid solution to form a porous silicon surface layer with nanostructure Si crystallites (wires); then a pn heterojunction diode was fabricated by depositing a wide band gap n-type semiconductor, indium-tin-oxide (ITO), onto the porous silicon layer. Visible electroluminescence was observed and measured only when a positive voltage was applied to the Si electrode--no light emission was observed under the reverse bias condition. In Phase I, we have also produced room-temperature red, orange, yellow and green photoluminescent porous Si and SiGe layers. Factors influencing the emission wavelength of the porous material include anodic etching process parameters, such as current density and substrate resistivity, as well as concentration of Ge in the SiGe alloys. Monolithic integration of Si-based light emitters with silicon IC's on the same chip is potentially useful for optical interconnect and display technologies.

SPIRE CORP.
PATRIOTS PARK
BEDFORD, MA 01730
Phone: (617) 275-6000
Topic#: 91-014 ID#: 91-275
Office: SDC
Contract #: DASG60-91-C-0075
PI: Nasser Hussein Karam
Title: Low Defect Density GaAs on Patterned Si
Abstract: The monolithic integration of GaAs based photonic devices (e.g. lasers) with the Si based VLSI technology has not yet overcome the high defect density in the GaAs (10E6-10E7 per cm2). Lasers fabricated in GaAs on Si die in minutes because of the high density of defects at the GaAs/Si interface due to the large mismatch between the two materials. Nasser Karam's Phase I SBIR says you can solve this problem by artificially limiting the number of nucleation sites on sawtooth patterned Si substrates (0.2 micrometer period) and preventing the formation of dislocations via a thin oxide layer (amorphous and less than 5 nm) which accommodates the GaAs/Si lattice mismatch. The thin oxide film adheres strongly to the V-shaped patterned Si and transmits the crystal symmetry but not the exact location of the atoms, hence eliminating dislocations (the cause of the problem). The research program will demonstrate the reduced defect density in GaAs (less than 10E5 per cmE2) and a working laser. Large-area wafer patterning is done by holographic lithography, and films are deposited by low pressure Metalorganic Chemical Vapor Deposition.

SPIRE CORP.
PATRIOTS PARK
BEDFORD, MA 01730
Phone: (617) 275-6000
Topic#: 91-014 ID#: 91-621
Office: DNA
Contract #: DNA001-91-C-0089
PI: Anton C. Greenwald, PhD
Title: Lanthanum-Nitride/Silicon Superlattice Infrared Detector by MOCVD
Abstract: Lanthanum nitride is a semi-metal with a bandgap of 40mRy and a crystal lattice parameter close to that of silicon. It has been suggested that a superlattice of LaN and Si can be fashioned with an effective gap of 0.1 eV, suitable for long wavelength infrared detection. In Phase I, Spire will attempt to deposit LaN epitaxially on silicon by low pressure metalorganic chemical vapor deposition, and measure its electrical properties. LaN has never been deposited before by CVD. This research is now possible through the development of new source chemicals related to studies of high temperature superconductors. Fabrication of a superlattice structure would be attempted in Phase II.

SPIRE CORP.
PATRIOTS PARK
BEDFORD, MA 01730
Phone: (617) 275-6000
Topic#: 91-014 ID#: 91-625
Office: SDC
Contract #: DASG60-91-C-0058
PI: Stanley M. Vernon
Title: Vertical Strained Layer Superlattice for High Speed Optoelectronics
Abstract: Opto/electronic devices one atom in size are the ultimate limit. An array of such devices has maximum possible

density and speed. That's our aim. Our approach - you have a flight of stairs, and a supply of red and green balls. You drop the balls, and somehow red ones collect on odd-numbered stairs, and green ones on even stairs. Subsequent balls line up on their respective color, building walls of different colored balls, in an alternating pattern. We use chemical vapor deposition to catch atoms on the naturally occurring 25-atom-wide steps of a semiconductor surface. Arriving atoms tend to collect first in step corners, and spread towards the edge. Careful control of our growth process places all "balls" into their proper sites. Initial results indicate it may actually work. Superlattices, (thin alternating horizontal layers) helped revolutionize opto/electronics in the 80's; vertical superlattices are the "next" frontier. Quantum-effect devices will result. Physicists are having a field day thinking up ways to use all these new possibilities.

SUPERCONDUCTOR TECHNOLOGIES, INC.
460 WARD DRIVE, SUITE F
SANTA BARBARA, CA 93111
Phone: (805) 683-7646
Topic#: 91-003 ID#: 91-485
Office: SDC
Contract #: DASG60-91-C-0068
PI: Timothy W. James
Title: Microwave-Based Infrared Detector
Abstract: Wide field-of-view space surveillance systems need revolutions in: sensor size and cost, signal processing speeds, available power an spectral range. Unique properties of superconductive components enable unique FPA architectures with consequent revolutionary improvements in performance. Santa Barbara Research Corp has demonstrated a novel microwave based infrared detector with first generation HTS materials configured as a superconducting transmission line cavity. Photons are detected as a shift in the cavity resonant frequency. Optimum performance needs the best quality single crystal films with the best microwave characteristics. This project teams Superconductor Technologies, Inc, a premier developer of high quality microwave films, and SBRC, a leading infrared detector and subsystem supplier. In Phase I, responsivity .vs. temperature and frequency will be measured for YBCO and TBCCO films and compared to theory.

SUPERCONDUCTOR TECHNOLOGIES, INC.
460 WARD DRIVE, SUITE F
SANTA BARBARA, CA 93111
Phone: (805) 683-7646
Topic#: 91-015 ID#: 91-073
Office: SDC
Contract #: DASG60-91-C-0093
PI: Dr. Lincoln C. Bourne
Title: Thallium Films on Bicrystal Substrates
Abstract: All "active" superconducting devices, such as magnetic field detectors with ultimate sensitivity (SQUIDs) and high-speed computer logic circuits are based on Josephson junctions. A junction is made by bringing two superconductors into weak contact, but this has been difficult using high-temperature superconductors. The best engineered junctions made so far in high-temperature superconductors have been in yttrium materials grown on bicrystal substrates; the crystal grain boundaries in the substrate control the location of the grain boundaries in the superconducting film. However, the randomly occurring natural grain boundaries in thallium materials give better junction behavior than gain boundaries in yttrium. Most laboratories have avoided working with thallium because of its toxicity, but Superconductor Technologies, Inc., has become a leader in development of thallium materials. In this contract STI will make engineered junctions by growing high-quality thallium superconductors on bicrystal substrates.

SUPERCONDUCTOR TECHNOLOGIES, INC.
460 WARD DRIVE, SUITE F
SANTA BARBARA, CA 93111
Phone: (805) 683-7646
Topic#: 91-015 ID#: 91-491
Office: AF
Contract #: F19628-91-C-0130
PI: Roger J. Forse
Title: C60 HGz GTSC Spatial Filter
Abstract: The purpose of this project is to build a quasi-optical millimeter wave bandpass filter using high-quality epitaxial high temperature superconductor (HTSC) Ti2BaCa2Cu2O8 films. This contract will expand on the work done by D. Zhang, D. Plant, and H. Fetterman at UCLA. Superconductor Technologies Inc., will attempt to replicate the results from UCLA using LaAlO3 substrates to determine if this type of filter is practical at higher temperatures (up to 77 degrees Kelvin). Possible uses include narrow band filters for millimeter wave applications. This type of filter has a potential for use in space communication systems as a preselection filter since it can be placed in front of an antenna or in a waveguide and requires no connectors. The filter can also be tuned by rotation.

SUPERCONIX, INC.
261 EAST 5TH STREET
ST. PAUL, MN 55101
Phone: (612) 222-0046
Topic#: 91-015 ID#: 91-437
Office: SDC
Contract #: DASG60-91-C-0062
PI: Cornell Chun
Title: Artificially Layered Materials with High Superconductive Critical Currents
Abstract: The innovation is an artificially layered material with ferromagnetic and Hi-Tc superconductive components. This has been achieved in Phase I by experimenting with various ferromagnetic and Hi-Tc materials. The original Phase I application was higher superconductive critical currents by pinning the magnetic flux in the ferromagnetic layer. However, after experimentation in Phase I, the application in the Phase II proposal has been switched to novel electronic devices. These combine the high frequency, high efficiency capability of superconductors with the large magnetic moments of ferromagnets to yield superior electronics. These concepts have generality and can be applied to many types of electronics. Higher efficiency, smaller size, and higher frequency performance are anticipated for a wide class of novel advanced electronics.

SYSTEMS CONTROL TECHNOLOGY, INC.
2300 GENG ROAD
PALO ALTO, CA 94303
Phone: (415) 494-2233
Topic#: 91-012 ID#: 91-466
Office: AF
Contract #: F29601-91-C-0063
PI: Abbas Emami-Naeini, PhD
Title: Integrated Active Space Structures Control Design
Abstract: Systems Control Technology will develop an integrated control/active structure design technique using H-infinity synthesis to integrate the design of precision pointing and active support controllers. SCT will provide an innovative procedure to design high-performance low-mass space systems which will combine active structural/control and the H-infinity design method, eliminate conflicting sequential control design goals, and optimize integrated system performance. In Phase I, SCT will design a control law to demonstrate improved disturbance-rejection properties in a subcell of a segmented precision mirror system. In Phase II, SCT would model the segmented optical structure with active structural elements and will demonstrate an integrated design of the optical alignment and structural control systems. Since this approach combines two proven techniques, using existing hardware, it will provide unprecedented improvements in flexible structure control.

SYSTEMS EVALUATION LABORATORY IN FLIGHT
PO BOX 7836
VAN NUYS, CA 91409
Phone: (818) 997-3636
Topic#: 91-003 ID#: 91-211
Office: ONR
Contract #: N60530-91-C-3400
PI: Howard H. Baller
Title: Multibeam Luneberg Optical/RF Lens for One or Two Way Communication
Abstract: Two original concepts are combined in our multibeam lens: a remarkable new lightweight glass, called Aerogel, and a translucent spherical Luneburg lens, formed of concentric spherical shells of graded refractive index, "n". A U.S. Patent issued in 1991 describes this technique. This glass opens the door to construction of the first useful optical Luneburg lens. Recently, Aerogel with "n" values greater than 1.4, ranging down to a few tenths of 1% greater than 1, has been produced. The lightest material is only a few percent heavier than air. Aerogel has millimeter wave characteristics similar to its optical response which leads to the possibility for simultaneous RF/optical sensing/communication in a single lens/aperture. Promising uses include: communications lines for large numbers of Brilliant Pebbles; all angle anti-satellite warning; tactical air defense missile warning; wide angle anti-collision sensing in crowded airspace near airports; and automobile collision warning.

TECHNICAL IMAGING SERVICES, INC.
PO BOX 1237; 380 FARMINGDALE ROAD
JACKSON, NJ 08527
Phone: (908) 905-2080
Topic#: 91-011 ID#: 91-095
Office: AF
Contract #: F49620-91-C-0055
PI: Miles Murdocca
Title: Optical Computer Architecture Using Reconfigurable Interconnects
Abstract: General purpose computers used in the United States and other countries typically achieve lower performance than can be achieved with special purpose computers for a given application. This Phase I proposal addresses a relatively unexplored capability that has emerged in optical computing, which is the ability to completely reconfigure the gate-level interconnects of

a digital computer on every clock cycle. The optical computing model used here makes use of arrays of optical logic gates interconnected in free space. Masks in the image planes block light at selected locations, thus customizing the gate-level interconnects. These masks need not be fixed, in fact they may be implemented with active logic gates, which offers the opportunity to completely reconfigure the gate-level interconnect on every clock cycle, although with a greater cost due to the increased number of active elements. Motivations for exploring this capability include fault tolerance, compact hardware realizations, remote reconfigurations, and better mappings from algorithms to architectures. The Phase I effort will explore the impact of gate-level reconfiguration on computer architecture, and the means for achieving a working prototype optical computer that exploits gate-level reconfiguration.

TETRA CORP.
3701 HAWKINS STREET N.E.
ALBUQUERQUE, NM 87109
Phone: (505) 345-8623
Topic#: 91-002 ID#: 91-429
Office: DNA
Contract #: DAN001-91-C-0081
PI: F. Eugene White
Title: High Repetition Rate Pulse Coaxial Induction Accelerator
Abstract: Tetra Corporation is developing innovative Electromagnetic Launcher (EML) technology for hypervelocity (2-10 km/sec), moderate mass projectiles (50 to 100 grams). This technology utilized a unique Linear Induction coaxial coil configuration driven by a near-arbitrary waveshape repetitive (200 Hz-10 kHz) pulsed power system. This technique represents a breakthrough in EML technology and provides significant improvement in efficiency, maximum velocity, energy recovery and repetition rate over conventional approaches. This new generator technology developed under SDIO and SPAWAR funding. The unique induction coil configuration matched to the coil driver provides for 80-90% projectile efficiency, 70-80% repetitive energy recovery, long system life (no electrical discharges or arcs) without high power high repetition rate opening or closing switches. Tetra's EML technology can aid in meeting DoD's Critical Technologies requirements in Hypervelocity projectiles and be applied to the Navy's Phalanx antimissile system and the Army's Vulcan antiaircraft system.

TETRA CORP.
3701 HAWKINS STREET, NE
ALBUQUERQUE, NM 87109
Phone: (505) 345-8623
Topic#: 91-005 ID#: 91-344
Office: AF
Contract #: F33615-91-C-2137
PI: Chris M. Young
Title: Tacitron Switch for Thermionic Reactor Power Conditioning
Abstract: The Tacitron is a high temperature (300 - 1500 degrees C) switch that can switch high currents (>10's of amperes per square cm of switch electrode area) and high voltages (>200 volts) at switching speeds in the 10's to 100's of kilohertz. This switch is fully controllable so it can perform the same functions as many of the semiconductor devices (transistors, diodes, thyristors) except that the Tacitron can operate at temperatures that are much hotter than the 200 degree C limitation of semiconductors. The Tacitron can also survive in high radiation environments such as the core of a nuclear reactor. Tetra Corporation is applying its unique modeling and diagnostics techniques toward increasing the performance of the Tacitron for a wider range of applicability. Important uses include: nuclear reactors, high temperature batteries, jet engines, and industrial furnaces.

THERMACORE, INC.
780 EDEN ROAD
LANCASTER, PA 17601
Phone: (717) 569-6551
Topic#: 91-001 ID#: 91-062
Office: SDC
Contract #: DASG60-91-C-0094
PI: John H. Rosenfeld
Title: Liquid Film Evaporation Cooled Mirror
Abstract: Evaporating a coolant from the surfaces of a fine porous wick can do something no other known cooling scheme can do: maintain a nearly constant surface temperature while the heat flux is varied by ten times or more. The program goal is to cool high-powered laser mirrors, and other tough cooling problems. The unique heat exchanger design is an advanced cousin of the heat pipe and of pumped two-phase (boiling) cooling designs developed by Thermacore. Liquid Film Evaporation (LFE) cooling works by maintaining a stable evaporating liquid film layer over the wick surfaces. As the heat flux goes up, the film thickness goes down, so the surface temperature changes are minimized. Absorbed heat fluxes up to 500 W/cm2 can be removed by LFE. Fundamentals are being studied in Phase I; Phase II will reduce the approach to practice with actual LFE

cooled mirrors.

THIN FILM CONCEPTS, INC.
2324 WILLOWAY STREET
YORKTOWN HEIGHTS, NY 10598
Phone: (914) 962-1779

Topic#: 91-015 ID#: 91-138
Office: AF
Contract #: F49620-91-C-0069
PI: Dr. Leslie S. Weinman

Title: Si-YBCO Reactive Patterning Technology for High Tc Superconducting Electronic Devices

Abstract: Commercial high temperature superconducting materials need two key techniques namely, large area deposition and large area patterning. Most commonly used processing techniques such as pulsed laser deposition and laser etching are limited to a small scale deposition and patterning of HTS films. By combining e-beam multilayer evaporation and rapid thermal annealing we quickly make large area films (up to 5 inches). Furthermore we have invented a novel method of patterning HTS films by a Si-YBCuO intermixing technique. This invention permits us to use well established silicon technology for making both micron-sized structures and large scale features without chemical contamination to the HTS surface. This unique patterning technique works for silicon substrates which opens the door for making hybrid devices with Si integrated circuits. We plan to further study the material properties of the Si-YBCuO intermixed system to improve the technique. We are developing mask sets for a demonstration project which will involve either switching or high frequency antennas.

TRYMER COMPANY
14301 BAGDAD ROAD
LEANDER, TX 78641
Phone: (512) 259-1141

Topic#: 91-005 ID#: 91-148
Office: DNA
Contract #: DASG60-92-C-0049
PI: Jon M. Schroeder

Title: High Energy-Density Electrical Storage Device

Abstract: A million Ampere ring storage device will use a novel thermopile concept, which when open-switched will power electric weapons such as electromagnetic guns. Several pile deaigns configured to maintain persistent current in the ring prior to initiation of an electric launch will be evaluated, using a combination of thermopile and electromagnetic induction. Thermopile and induction coupling variants will be tested in a scale version of the proposed storage ring. The project will result in the development of a preliminary design for a 20 inch, 120 MJ power supply weighing 1000 pounds.

ULTRAMET
12173 MONTAGUE STREET
PACOIMA, CA 91331
Phone: (818) 899-0236

Topic#: 91-002 ID#: 91-483
Office: SDC
Contract #: DASG60-91-C-0087
PI: Robert H. Tuffias, PhD

Title: Zero-Erosion Throats for Solid Propellants

Abstract: Advanced solid rocket propellants are currently available today that would provide a substantial increase in performance and/or reduction in launch cost. They cannot be used, however, because the technology of containment materials is not sufficiently advanced. In this Phase I program, Ultramet proposes to develop innovative processing methods applied to unique materials to fabricate near-zero erosion throats for these ultrahigh temperature solid rocket motors and demonstrate their performance. Systems requiring the benefits of improved nozzle throat erosion are varied and numerous. Among them are the advanced solid axial stage, kinetic energy antisatellite systems, Brilliant Pebbles, guided bomb propulsion systems, and all other military space applications. Additional applications for this technology will include uncooled leading edges for hypersonic vehicles and reentry vehicles, as well as high performance gun barrels.

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Topic#: 91-007 ID#: 91-328
Office: AF
Contract #: F29601-91-C-0060
PI: David Raine

Title: Lightweight High-Efficiency Heat Transfer Panels

Abstract: Heat engines based on various thermodynamic cycles are being developed for space power applications. A need clearly exists to minimize weight while maximizing the thermal efficiency of such power systems. High temperature heat pipes are a

versatile, efficient means of transporting and managing thermal energy in such applications. In a previous program, Ultramet developed and demonstrated an innovative process for fabricating a very lightweight composite heat pipe container having the excellent strength, high temperature capability, and corrosion resistance (to the liquid metal working fluid) necessary to withstand the operating environment of a high performance space heat pipe. In this Phase I program, Ultramet proposes to apply its previous experience toward development of practical hardware. Ultramet an.. Hitco, a leading carbon-carbon manufacturer, will combine efforts toward the fabrication of planar carbon-carbon panels, incorporating W:10%Re heat pipes for energy dissipation. The program will combine the proven benefits of Ultramet's CVD heat pipe fabrication process with Hitco's state-of-the-art high conductivity carbon-carbon manufacturing ability.

UNIAX CORP.
5375 OVERPASS ROAD
SANTA BARBARA, CA 93111
Phone: (805) 967-0578
Topic#: 91-014 ID#: 91-101
Office: AF
Contract #: F49620-91-C-0092
PI: Dr. Floyd L. Klavetter
Title: Soluble Precursor Route to Polyanilines
Abstract: Polyaniline is of interest for potential commercial applications because it is simple and inexpensive to synthesize, and because it is both environmentally stable and stable to relatively high temperature (200 degrees Celsius). However, to take full advantage of the opportunities offered by this stable conducting polymer, new methods for processing must be created. The Phase I effort will develop a novel synthesis to polyaniline through a precursor polymer which is soluble in (and processible from) common organic solvents. The precursor route will enable solution processing into a desired composite or monolithic shape with subsequent conversion to polyaniline through a simple thermal elimination reaction. UNIAX will develop and optimize the proposed synthetic route to produce both a soluble precursor polymer and precursor solutions into films and fibers will be initiated; this program will become the foundation of the Phase II effort.

UNIVERSAL ENERGY SYSTEMS, INC. (UES)
4401 DAYTON-XENIA ROAD
DAYTON, OH 45432
Phone: (513) 426-6900
Topic#: 91-014 ID#: 91-569
Office: DNA
Contract #: DNA001-91-C-0090
PI: Perter P. Pronko
Title: Radiation Response of Epi-Less Bond Etch Silicon-on-Insulator Fabricated with MeV Ion Implantation
Abstract: Epi-less bond etch silicon-on-insulator (EL-BESOI) using MeV ion implantation is a new approach to fabricating high quality SOI particularly for very thin SOI (100-300 nm) as required for use in high speed, fully depleted, CMOS device structures. And the radiation response of such SOI material is a continuing concern for radiation environments such as space, reactors, or nuclear bursts. Bonded SOI material is unique in that the oxide can be custom designed or modified during fabrication for a degree of control of radiation hardness properties. This program will study such oxide fabrication techniques and evaluate them for radiation response under intense x-ray, electron, and proton bombardment. Additionally, optimization of the MeV EL-BESOI manufacturing process will also be pursued for 3" and 4" wafers.

XACTON CORP.
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TEMPE, AZ 85280
Phone: (602) 966-8765
Topic#: 91-003 ID#: 91-066
Office: AF
Contract #: F33615-91-C-1739
PI: Bal K. Jindal
Title: Mercury Cadmium Telluride Substrate for Focal Plane Arrays
Abstract: High quality wafer of Mercury Cadmium Telluride are critically needed for the fabrication of Infrared Focal Plane Arrays. Defense related applications of these arrays include: surveillance, target detection, acquisition and tracking, missile guidance, thermal imaging, navigational aids and night vision. For operation in the back-side illuminated mode it is required that the active device layer of Mercury Cadmium Telluride be deposited on a suitable substrate material. The substrate material must meet a number of stringent requirements and the development of suitable substrate has been a formidable task. Recently Xacton has achieved a major breakthrough in the Mercury Telluride technology. Based on this, we proposed the use of high quality wafers of Mercury Cadmium Telluride as a substrate material for the epitaxial growth of active layers of Mercury Cadmium Telluride. The substrate can be made transparent to the incoming radiation by tailoring its composition to be slightly more Cd rich than that of the active epitaxial layer.

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Topic#: 91-003 ID#: 91-186
Office: SDC
Contract #: DASG60-91-C-0067
PI: Bal K. Jindal

Title: CdTe Optical Components in Long Wavelength Infrared Systems

Abstract: Infrared systems are needed for a variety of Defense related applications, such as: surveillance, target detection, acquisition and tracking, missile guidance, etc. For many applications such as those involving cold-dim targets, these systems need to operate in the very long wavelength region of the Infrared Spectrum, e.g. 15-35 microns cutoff. In this wavelength region, the availability of suitable materials for optical components such as windows, lenses and filters etc, is a significantly important issue. For these applications, based on physical and chemical properties, CdTe is an excellent choice, superior to other known materials. However, its usage has been severely limited due to the lack of a suitable process for the growth of high quality and large area wafers of it. Recently, however, Xacton has achieved a major breakthrough by developing a new process for the growth of II-VI compounds, and will apply this process to the growth of CdTe.

XERAD, INC.
1526 14TH STREET, SUITE 102
SANTA MONICA, CA 90404
Phone: (213) 458-6557

Topic#: 91-002 ID#: 91-341
Office: AF
Contract #: F08630-91-C-0044
PI: Dr. Robert M. Salter

Title: High Efficiency, Relatively Low-Current Input

Abstract: In 1971 Australians Barber and Marshall railgun-accelerated a small projectile to 7 km/s; spawning a new era of electric hypervelocity launchers for weapons, space launch, and impact fusion. Among electromagnetic candidates only the railgun achieves multi-kilogee accelerations needed for short-barrel guns. However, input currents of Mega-to-Giga-amperes are required. Also in the conventional railgun half of the input energy stays behind as residual field. Yet further, restrike effects in the plasma "armature" presently limit launch speeds to ~6 km/s. The GRAIL railgun offers to provide (proprietary) solutions to these problems as well as to eliminate muzzle flash.

DARPA TOPIC NUMBERS:

DNA TOPIC NUMBERS:

SDIO TOPIC NUMBERS:

(Note: This reference contains the firm names and topic numbers for the DoD SBIR Phase I awards listed in this volume and the other three volumes.)

FIRM NAME: